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CONTENTS.

	PAGE
Acute Leukæmia. By Charles P. Emerson, M. D.	71
The Necessity of a More Uniform Nomenclature of Diseases for Study and Teaching. By Thomas Morgan Rotch, M. D.	85
Benjamin Rush, as Materialist and Realist. By I. Woodbridge Riley, Ph. D.	89
A Case of Multiple Tumors in a Dog. By Ernest K. Cullen, M. B.	101
Note.	101
Notes on New Books.	103

ACUTE LEUKÆMIA.

By Charles P. Emerson, M. D.,

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During the past year three cases of so-called acute leukæmia have been treated in the medical wards of the Johns Hopkins Hospital. These have been of so much interest, and have presented certain features of such unusual nature that it is thought to be of value to report them.

Case I.—*A case of acute lymphatic leukæmia without enlargement of lymph glands or spleen, with localized involvement of the bone-marrow, and with very many white cells soluble in dilute acetic acid.*

W. A. C.; age 35 years; male; white; Gen. No. 52738. Admitted Oct. 30, 1905. Died Nov. 1, 1905. Clinical diagnosis: Acute lymphatic leukæmia.

The patient came complaining of "weakness."

His family history was negative, except that his father was a heavy drinker.

The past history was also negative, since he claimed to have "always enjoyed good health." He has had measles, mumps, and whooping cough. He denied having had typhoid fever, pneumonia, rheumatism, pleurisy, scarlet fever, chronic cough, stomach trouble, or any urinary disturbance. He admitted gonorrhœa, buboes, chancre, but denied all secondaries. His work kept him out of doors most of the time. He was usually a little constipated. He took an "occasional drink," but not one every day.

Present illness.—The patient said this began insidiously, and was first noticed September 1 of this year (just eight weeks ago). He first noticed weakness, hence, taking September for his vacation, he went on a pleasure trip during which he became much worse and was in bed one week because of the weakness, his one symptom. Since then he tired very easily, was dyspneic on exertion, but had no pain, no nausea, and no vomiting. He had slight constipation; his appetite was fair. He was not pale, had no swollen glands, no increased micturition, no swelling of the feet, no cough, no sweats, and no hæmorrhage, although during the past three months he had noticed some oozing from his gums. He was admitted for increased weakness, slight nausea, and loss of appetite. He had lost considerable weight. He knew of no one with a similar trouble.

Such was the history given by the patient. After his death, however, his mother gave the interesting information that during his vacation trip she thought he did not look well, and on one occasion long-continued hæmorrhage followed the extraction of a tooth.

Physical examination.—The patient was rather sallow in color and appeared very weak. He was of fair muscular development, but had evidently lost some weight. The skin was thin and transparent, the superficial veins quite visible; the scleræ were pearly, the conjunctivæ pale and not bile-stained. The eyes were negative.

The mucosæ were very pale; there was a slight hæmorrhage on the inner surface of the lower lip. The tongue was heavily coated.

The tonsils were not visible, there was no obstruction to the nares, no palpable glands in the neck, and none in the axillæ or inguinal regions. There was no evidence of enlarged glands in the abdomen.

The veins of the neck and thorax were full, those on the left side being more so than on the right, and showed a positive, systolic, centrifugal pulse.

The thyroid gland was negative.

The chest was long and flat, and the respiratory movements good and equal on both sides. In the lower left axilla the breath sounds had a tubular modification, with expiration prolonged;

showers of râles on inspiration and a few on expiration. The same was true of the lower back below the spine of the scapula; otherwise the lungs were negative.

The heart was not enlarged; there was a blowing systolic murmur at the pulmonic area, which was heard also at the apex, but not beyond it; otherwise the heart was negative.

The liver dulness began at the upper margin of the sixth rib in the right mammary line, and extended five centimeters below the costal margin. The spleen was not palpable. The abdomen was otherwise negative.

The patient brought with him an excellent blood report made a few days before his admission to this hospital, which read as follows: "Hæmoglobin, 25% (Tallqvist); red corpuscles, 944,000 per cmm.; white corpuscles, 428,000 per cmm.

Differential leucocyte count: Polymorphonuclear neutrophiles, 0.9%; small mononuclears (lymphocytes), 2.0+%; large mononuclears (lymphocytes), 96.0%; eosinophiles, 0.5%; mastzellen, 0.5%.

A few neutrophile and eosinophile myelocytes are encountered. The large mononuclears are unusually large, with nuclei eccentrically placed, and take a very pale stain. Many are egg-shaped and quite rich in chromatin, the latter being scattered over some and collected in bunches in others. Many show degenerative changes, and some are undergoing karyokinesis. Blood platelets are very scarce. Many red cells are microcytic; poikilocytes are absent. Nucleated reds are very scarce, only one megaloblast being found while counting the leucocytes. They take the stain throughout and very few show a ringed appearance." (H. S. H., Asst. Bacteriologist, State Board of Health, Fla.)

On October 31 we found: Hæmoglobin, 17% (Dare); red corpuscles, 752,000; leucocytes, 880,000; large mononuclears, 97.2%; small mononuclears, 1.9%; polymorphonuclear neutrophiles, 0.51%; neutrophile myelocytes, 0.34%; polymorphonuclear eosinophiles, 0.25%; mastzellen, 0.05%.

The predominating cell was a palely-stained mononuclear with vacuolated nucleus, and abundant basophilic protoplasm, whose size varied from that of a lymphocyte to a giant cell. Very few normoblasts were present. It took fully half an hour to allay the hæmorrhage from the pin-prick in the ear, made to get the blood for the above examination.

During the afternoon of October the 31st, the patient grew weaker, and in the evening was unable to sign some business papers.

November 1, at 2.45 a. m., the patient became comatose. His dyspnœa was a remarkably good illustration of air hunger; each inspiration shook his whole body and yet the air passages were perfectly free. He died at 4.30 a. m.

The urine on admission was clear, yellow in color, having a specific gravity of 1012, with acid reaction, no albumin, no sugar, and no sediment. The following day the urine was similar in appearance, over 700 ccs. in amount; its specific gravity was 1013, with acid reaction, no sugar, the faintest trace of albumin, and a few granular casts. There was no acetone, no diacetic acid, and the Diazo test was negative. The temperature varied from 98.9° to 100.2°, and was 100.6° at death; the pulse varied from 112 to 120, and the respirations from 20 to 28 to the minute.

Autopsy, November 1, 1905, 12.30 p. m. No. 2615.

Anatomical Diagnosis.—Acute lymphatic leukæmia; dilatation and fatty degeneration of the heart; hydrothorax left side; œdema of the lungs; subcutaneous, subserous and submucous ecchymoses; chronic gastritis; pyoid hyperplasia of the bone marrow of the vertebræ.

The following is a very brief abstract of the anatomical report:

The body is well built and well nourished. The inguinal, cervical and axillary glands are palpable, firm, but not much enlarged. The abdominal subcutaneous fat is plentiful in amount. Scattered through it are minute cherry-red areas, from 1 to 3 mm. in diameter: similar nodules are in the mesenteric fat. Mesenteric lymph glands are small. The left pleural cavity contains many old fibrous adhesions over the anterior aspect of the lung. In the right pleural cavity are about 5 ccs. of blood-stained, cloudy, serous fluid.

Heart.—There are numerous small hæmorrhages under the epicardium. The cavities contain firm clots, deep red in the dependent parts, and above consisting of layers varying in color from grayish-pink to light yellow with a greenish cast in places.

The lungs are quite free from interesting features.

The spleen measures 14 by 7.5 by 3 cm., and weighs 185 gms. The capsule is slightly thickened at points, but translucent for the most part. On section the trabeculæ are inconspicuous. The pulp is of a pale brownish-red color with small hæmorrhages scattered through it. The Malpighian bodies are enlarged, but are not sharply outlined. The organ is firmer than normal.

The liver weighs 1800 gms., and measures 25 by 19.5 by 9.5 cm. Its edges are sharp and somewhat irregular. The surface and cut surface are uniform in color, with no macroscopic nodules. The gastro-hepatic lymph glands are enlarged and fairly firm, with an opaque, grayish-pink color and a slightly rusty tinge on section.

The stomach, pancreas, kidneys, adrenals, bladder, genital organs, are all without lesions worthy of note here.

The aorta is narrow in its lumen, measuring when opened 5.5 cm. at the arch and 4.2 cm. at the celiac axis. The lymph glands along it are prominent, but not especially enlarged. On section they are rather opaque, of a yellowish-white color, with here and there small areas of congestion.

Intestines.—The mucosa of the jejunum is pale. It appears somewhat thickened as also do the transverse folds. The surface is coated by a considerable amount of mucus. As one approaches the ileum he finds here and there an area of injection and submucous ecchymoses, together with a few small, slightly elevated nodules surrounded by an area of injection; they are slightly elevated, but show depressed pigmented areas giving them the "shaven-beard" appearance. The appendix is normal. The large intestine is also normal save for a few nodules similar to those above mentioned.

The ribs appear to be free from bone-marrow. The trabeculæ of the bone stand out prominently, but have no tissue between them. The bone marrow taken from the center of the femur is fatty, but shows slight hyperplasia at its periphery, the peripheral part here being a little more opaque and of a grayish color. In the vertebræ the marrow is soft, opaque, grayish-pink in color, and almost fluid, resembling somewhat the blood clots in the vein.

Microscopic Examination.—*Blood Clots.*—The nucleated cells predominate, especially those of the large lymphocyte type; nucleated red cells are numerous. Mitotic figures are present.

Bone-marrow.—The femoral bone-marrow is fatty. Between the fat cells are but few cells of the blood group, and these are apparently in vessels. The rib and vertebral marrow resemble the clots in the heart, and the nucleated red cells are few.

Lymph glands.—In the bronchial tubes the lymph cords and follicles are small, and the cells are of the large type. The lymphocytes are few. The mesenteric glands show a chronic lymphadenitis with marked thickening of the fibrous structure, especially of the medulla of the gland.

Spleen.—The fibrous framework of the pulp is increased in amount. The Malpighian corpuscles are very small, showing hyaline masses, some of which are agglutinated red blood cells.

Intestines.—There is chronic enteritis with sclerosis at the base of a Peyer's patch, and areas of necrosis at the center of a patch. There are no lymphoid nodules in any organ.

This is a typical case of acute leukæmia of the so-called

lymphatic or lymphoid, or better still, myeloblastic type. Its duration was about two months, and its most striking features were the very high white cell count and the extreme anæmia.

The case was not only truly myelogenous but the lesion of the bone-marrow was apparently localized in the vertebral column. The spleen, liver, lymph glands, tonsils, and lymphatic deposits along the intestine were all free. The rib and femoral marrow were free from lesion, which may explain the absence of tenderness of the long bones, as was present in the cases of Ritter,[1] Türk,[2] and Gordinier.[3] This case illustrates a point emphasized some time ago by Grawitz and others that marrow from several bones must be examined before any statement can be made concerning their involvement. Had the pathologist stopped in this case with the examination of the ribs and femur the case could have been reported as "acute leukæmia without bone-marrow lesion." In reporting such cases the pathologist should state what marrows were examined. This Drozda[4] did not do, and Dennig[5] may not have looked far enough.

This case was acute, though lasting about two months; not a *leukæmia acutissima* of from four to ten days' duration. It belongs perhaps to the acute cachectic group.

There was hypoplasia of the aorta, its diameter being quite narrowed, which reminds one of chlorosis, a disease which Virchow considered congenital, and associated with hypoplasia of the cardiovascular system. The same may have been true of Pfannkuch's case,[6] who was pale for years, also of the case of Sondern and Mendelson.[7]

The patient's mind, as also in Case II, showed considerable mental hebetude at the last; but earlier in the disease, as is the rule, clearness of intellect and comfortableness of condition marked the two cases.

Acute leukæmia is a condition which may be suspected but cannot be diagnosed without a blood examination. It is protean in form, suggesting both in onset and course many other diseases, among which are acute tonsillitis, diphtheria, scurvy, typhoid fever, malaria, tuberculosis, ulcerative endocarditis, purpura hæmorrhagica, septicæmia, pyemia, pernicious anæmia, and osteomyelitis.

A common form is the "typical" form suggesting chronic leukæmia and differing from it only in its greater acuteness and severity. There is sudden enlargement of the lymph glands of all or of certain groups. In some cases, the glands of the mesentery and the lymphatic tissue along the intestine are involved. The tonsils are enlarged, sometimes they almost touch; the thymus persists.[8] There are even lymphoid nodules of the dura mater.[9] The spleen is usually enlarged, early, if not at first, and the liver also. In these cases the diagnosis is easy since the clinical picture suggests leukæmia, but great difficulties are in the way of the determination of the acuteness of the case, since a preceding, latent, chronic leukæmia is very hard to rule out. One is usually safe in assuming that the blood condition has lasted at least as long as the discovery of enlarged glands or large spleen (but see page 84). To find the spleen large and hard on first examination is evidence against acute leukæmia, hence we have ruled out some cases reported in literature under this title. One may expect to watch the spleen grow in size and firmness. Yet this is not always true. Cattin[10] reports an acute case in which after four weeks' illness the spleen weighed 2500 gms. In some cases the lymph glands enlarge late and then increase rapidly in size.

The acute infectious type is not uncommon. At first it simulates typhoid fever, and later not one element of acute streptococcus septicæmia is absent except the demonstration of the organism. Case II is an excellent illustration of this type. The high fever, continuous or intermittent, the chills and sweats, the extreme prostration, rapidly developing anæmia, even the keen mind suggesting a streptococcus infection, all make a very suggestive picture. There are some (Rose Bradford, Barlow, and Osler) who hold that these cases are acute infections in which the changes in the blood are but a blood reaction, and a very different disease from the ordinary chronic leukæmia. It is certain that true septicæmias can produce a blood picture quite like acute leukæmia, and in the bone-marrow of cases otherwise clearly acute leukæmia organisms have been found. Holst[11] reported three such cases of acute leukæmia. In the first streptococci were isolated from the exudate of the knee and at autopsy from the lymph glands and blood. From the second bacilli and streptococci were isolated at autopsy. In the third streptococci were isolated from the bone-marrow. The abstract of this papepr in French gives no details of the cultures. Again, only an infectious disease would be likely to produce both the blood and marrow changes, and acute enteritis, acute pleurisy, acute bronchitis, acute endocarditis, and acute nephritis, all of which were found in our Case II.

It has long been known that acute infections may cause a high leucocytosis with many myelocytes, and resemble acute myelocytic leukæmia, also a blood picture with normal leucocyte count but the formula of acute lymphoid leukæmia. Holst's second case had a count of 8300, 77% of which were large lymphocytes, 14% small lymphocytes, and 8.3% polymorphonuclear neutrophiles. In his third case the count was 8400 and the large mononuclears 93%. The latter was clearly a streptococcus infection of the marrow. Whether all our cases of acute leukæmia will be shown to be due to infections is the question.

[1] Deut. Med. Wchs., 1904, p. 1042.
[2] Ibid., 1903, p. 355, Ver.
[3] Johns Hopkins Hosp. Bull., Oct., 1904.
[4] Deut. Med. Wch., 1902, Vol. 28, p. 340.
[5] Münch. Med. Wchs., 1901, No. 4, p. 140.
[6] Münch. Med. Wchs., 1904, Vol. 51, p. 1732.
[7] N. Y. Med. Jour., 1905, Vol. 82, p. 1154.
[8] Gordon's Case, Lancet, 1906, II, p. 1759; Kelly's Case III, Trans. Assoc. Am. Phys., 1903, XVIII, p. 481; and Phear's, Tr. Royal Med. and Chir. Soc., London, 1901, p. 453
[9] Chloromata (?), Drozda, Wien Med. Wchs. 1903, LIII, p. 405.
[10] Anjou Méd., Angers, 1903, X, p. 325.
[11] Norsk. Mag. f. Lægevidenskaben, 1904, p. 1098.

Schupfer[12] brought evidence against the infectious nature of this disease by injecting blood from such a patient into cancer cases, and since no change occurred in the cancer, which as a rule reacts in a marked degree to acute infections, he considered the infectious nature of acute leukæmia doubtful.

Other cases suggest a local collection of pus, as abscess of the liver (see page 80).

A large group of cases assumes the "hæmorrhagic form." Some suggest purpura hæmorrhagica, or morbus maculosus Werlhofii, as in Osswald's case[13] and Shattuck's case[14] of "infectious purpura." The patients are covered with subcutaneous, submucous, and subserous hæmorrhages; there are hæmorrhages into conjunctivæ, retinæ, and from nose,[15] mouth, stomach, and bowel, and they may die from cerebral hæmorrhage (Gordon). They sometimes develop local hæmatomata, as did Barié and Salmon's patient,[16] in which case a hæmatoma the size of a nut appearing just below the angle of the right scapula, grew so rapidly that on the third day it was the size of an infant's head. It was later opened and 1300 gms. of blood evacuated. These cases are usually fulminant, the anæmia extreme, and the diagnosis made at autopsy.

Another, to which Case I belongs, is the acute cachectic group. Sudden inexplicable weakness, loss of flesh, shortness of breath (Türk, Grawitz, Gordinier), and prostration increasing till death, with perhaps a few petechiæ and ulcers in the mouth, if one looks sharply, yet not so fulminating a course nor with such high temperature as the former, if indeed there is any fever; such is the clinical picture. This is the group mentioned by Josserand as simulating pernicious anæmia. These patients are very pale with a slight but definite jaundice, in addition to the features above mentioned. But the tint is not the same; there is not the brownish pigmentation of primary pernicious anæmia, but rather a whitish pallor, and there is emaciation. They look sicker.

The "bucco-pharyngeal" mode of onset first emphasized by Gilbert is by far the most common, and these symptoms may continue so long that the cases constitute a distinct group, although the majority of cases in the other groups also begin in this way. There are very few cases in which one or more lesions in mouth or larynx cannot be found if carefully looked for. It is even believed that the portal of entry of the disease is through these mouth and throat lesions.

This group is divided into the pseudoscorbutic and the pharyngeal forms. In the pseudoscorbutic type swelling and tenderness of the gums may be the first sign. There is a severe stomatitis often gangrenous, with oozing from the gums, areas of necrosis along the edge of the alveolar processes, and submucous hæmorrhages. With the stomatitis the submaxillary glands are enlarged. Many cases appear to start with the removal of teeth, or at least the hæmorrhage following that operation is the first symptom. Such was true of Case I, of Grawitz's case,[17] from which fourteen teeth were extracted. Some cases resemble malignant disease of the upper jaw (Bradford). Gangrenous ulcers of the mouth are very common, especially ulcers connected with decaying teeth. These may precede the blood changes, and are the symptoms from which the disease dates. The cases of the pharyngeal group begin usually as an acute follicular tonsillitis or as diphtheria as did Edsall's,[18] Patoir and Dehon's[19] and Surmount's.[20] So common are such cases that it may be stated as a dictum "with diphtheritic throat and purpuric eruption in a child, look at the blood," (Jeanselme and Weil.[21]) The blood condition has been attributed to the use of anti-diphtheritic serum. Such cases are probably acute leukæmia beginning with a gangrenous pseudoangina. The most common sequence in children is, "diphtheria" with gangrenous tonsils, then "purpura hæmorrhagica," then enlargement of lymph glands, liver, and spleen, then "lymphatic leukæmia." In other cases, especially in adults, the sequence is, severe anæmia with intense pallor and extreme feebleness, then profuse hæmorrhages from nose, mouth, etc., then the purpura, and from the first a gradual enlargement of the lymph glands, liver, and spleen. In Lazarus's case[22] the tonsils were covered by a purulent exudate containing staphylococci and streptococci. It is interesting that the cervical glands may become enlarged before the tonsillar signs appear, evidence against the primary nature of the latter lesion. Sometimes a hæmorrhage into the tonsil is the first sign. Gangrenous ulcers in the tonsil have been mistaken for luetic chancres. Adenoids are sometimes abundant in the posterior nares.

In addition to the purpuric cases is a group in which cutaneous lesions are the most striking features. It is possible that Mannaberg's case[23] was one simulating lues rather than a maculo-papular syphilide which later became leukæmia. Holst[24] reports a case with thickly studded, painless nodosites on the skin of the face, breast, and back, some even the size of a pea. Stevens' case[25] is interesting since he thinks that the subcutaneous lymphocytic nodules which varied in size from a millet seed to a threepence in size, were chloromata. A discussion of the skin lesions is given by Aguinet and Ribadeau-Dumas.[26] Masses just above the elbows appeared in our Case II, evidently of lymphatic tissue, which we feared would become gangrenous.

Some cases begin as an acute gastro-intestinal intoxication,

[12] Reviewed in Jour. Am. Med. Asso., 1905, II, p. 882.
[13] Corresp. Bl. d. Schw. Aerzte, 1904, Vol. 34, p. 145.
[14] Jour. of Cut. Dis., 1904, II, p. 118.
[15] Elder and Fowler, Edinb. Med. Jour., 1904, Vol. XVI, p. 502; and Blackader, Arch. of Ped., 1905, Vol. XXII, p. 890.
[16] Bull. et Mém. de Soc. méd. de Paris, 1903, XX, p. 193.
[17] Klin. Path. des Blutes, 1902.
[18] Am. Jour. Med. Sc., 1905, Vol. 130, p. 589.
[19] Echo méd. du Nord, Lille, 1905, Vol. IX, p. 301.
[20] Ibid., 1904, Vol. VIII, p. 553.
[21] Pédiat. prat., 1904, II, p. 52, Bull. et mém. Soc. méd. des Hôp. de Paris, 1904, XXI, p. 185.
[22] Deut. Med. Wchs., 1905, Vol. XLII, p. 1209.
[23] Deut. Med. Wchs., 1902, Vol. 28, Ver. p. 70.
[24] Norsk. mag. f. Lægevidenskaben, 1904, p. 1098.
[25] Glasgow Med. Jour., 1903, Vol. LX, p. 1.
[26] Arch. gén. de Méd., 1905, II, p. 1928.

with severe vomiting and diarrhœa.[27] Diarrhœa is a very common symptom (Case II). Some begin as acute nephritis with œdema of the feet and of the eyelids so marked that the patients can hardly see. Türk's case had albumosuria.

The number of cases with pulmonary features is so great that an intimate relation between the conditions may be suspected. Some begin as an acute bronchitis,[28] even a bloody bronchitis. Others have acute pleurisy, Case II. The lymphomatous infiltrations with secondary necrosis and ulceration in the mucosa of larynx and pharynx were well described by Virchow. The same occur in the bronchi. Other patients have pain in the joints. Pain over the long bones is a common feature (see page 84). Two cases have recently been reported as associated with pregnancy.[29]

Cases with various pareses are reported, as of the external rectus of the eye, of the leg muscles, etc.

The *blood* in this case was typical of acute leukæmia; the severe anæmia, only 752,000 red cells, the high leucocyte count of 880,000, exceeding the red count, the few signs of regeneration, the large percentage of large lymphocytes, 97.2%, and the great scarcity of granular cells.

Although the red cell counts in this variety are usually very low (very rarely any lower than this case[30]) a progressive severe anæmia is almost an essential symptom, yet this is not always true, as in our Case II; Kelly's Case III with reds 3,590,000; Larrabee's[31] with reds 4,392,000; Wister and Gwyn;[32] Shattuck[33] with 3,024,000; Gordon;[34] and Türk's with 6,976,000 (Hb. 17.2 gms.).

In some cases the red count rises, due perhaps to diarrhœa, etc., as in our Case II, and Rosenberger's.[35] In all cases rapid destruction of red cells does not occur, although it is the rule. The relation of these cases to "pernicious anæmia" since many believe that both are the result of buccal infections, as well as to acute leukæmia, chloroma,[36] and sarcomatosis leukæmia,[37] multiple myeloma ta with the presence of Bence Jones' body in the urine, and lymphosarcomatosis[38] is an interesting problem.

The color index in Case I, was over 1, *i. e.*, 1.2, a point which McCrae[39] has emphasized as a very common feature of the acute cases.

The failure of the blood clots to contract, so much emphasized by Hayem and his school,[40] has not been much studied here.

The leucocytes in this case numbered 880,000, rather high for this form in which the counts are more apt to run from 150,000 to 200,000 cells. It is unusual for the whites to outnumber the reds as in this case their ratio being 1.2:1. The highest count in the three cases reviewed by Hamman[41] was 958,000. These were all "lymphatic" cases, but in Pfannkuch's case[42] of myelocytic leukæmia, they numbered 1,000,000. Slade's case[43] had a count of 1,300,000 but it was not an acute case, although often quoted as such. One feature quite marked in our Case II and often seen in acute leukæmia, judging from the literature, is the rising count. It is almost normal at first when the symptoms are severe enough to bring the patient to the clinic; it then increases till its height may lead one to suspect the diagnosis, and reaches a fairly high point at death.

In Case I the cells rose from 12,400 to 184,000 in thirteen days, a rise of 13,200 cells per day. A low count on admission rising rapidly later was also a feature of Kelly's case (17,000, 35,000, 105,400, 119,500, 163,000, counts almost the same as ours). In McCulloch's case[44] the cells rose from 15,000 to 37,600, and in Bensaude's case[45] from 44,640 to 135,780 in eight days. In Januszkiewicz's case they rose from 52,500 to 165,000. These very rapid variations in the count are explained as evidence of the rupture of "sarcoma" cells through the walls of the blood-vessels.

In still other cases the count after rising falls before death, as in Nichols' case,[46] in which the counts were 67,800, 134,800, 29,600, and 22,150. The first of Holst's three cases,[47] and one from which organisms were isolated, is most instructive. The counts of this case of clear acute lympnoid leukæmia were 93,000, 130,000, 58,000, and one day before death, 1600. This drop may be due to the production of many very sensitive cells or to "exhaustion" of the bone-marrow. Wolff[48] mentions cases of leukæmia which became "pseudoleukæmia." He considers a drop in count a bad sign if due to aplasia of the hæmatopoietic organs. It is also his opinion that many periods of apparent improvement with low count are really pseudoremissions due to lytic processes in very sensitive cells (see page 76).

The cells of Case I were chiefly mononuclear nongranulars, 97.2% large, 1.9% small. Other cases may exceed this by a small fraction of this last per cent, as Fatal's of 99.8%.

Acute leukæmia with normal blood count but with characteristic formula is not a rare clinical occurrence, and the opinions concerning it vary (see page 83).

[27] Pfannkuch, Münch. Med. Wchs., 1904, Vol. LI, p. 1732.
[28] Gordinier, loc. cit., Our Case II.
[29] Lazarus Deut. Med. Wchs., 1905, Vol. XLII, p. 1209.
[30] Laurent's case, Lyon Méd., 1906, p. 892, had a count of 7[illegible]00 cells.
[31] Bost. M. and S. Jour., 1905, Vol. 152, p. 40.
[32] Univ. of Penn. Med. Bull., 1904-5, XVII, p. 42.
[33] Loc. cit.
[34] Lancet, 1906, II, p. 1759.
[35] Am. J. Med. Soc., 1904, Vol. 128, p. 583.
[36] Bramwell, Trans. Edinb. Med. Chir. Soc, 1902, Vol. 21.
[37] Drozda, loc. cit.
[38] Türk, Wien. Klin. Wch., 1903, XVI, p. 866.
[39] Brit. Med. J., 1905, I, p. 404.
[40] Bull. et mém. de Soc. méd. d. hôp. de Paris, 1903, XX, p. 167.
[41] Am. Med., 1904, Vol. VII, p. 139.
[42] Loc. cit.
[43] Lancet, 1905, I, p. 572.
[44] Montr, M. J., 1904, Vol. XXXIII, p. 580.
[45] Bull. Med. Par., 1904, XVIII, 1101.
[46] Am. Med., 1903, Vol. V, p. 827.
[47] Loc. cit.
[48] Deut. Med. Wchs., 1905, Vol. XXXI, p. 85.

Since Neumann's work it has been a more and more generally accepted idea that of the leukæmias the acute at least are purely myelogenous. This being granted it may possibly be better to drop the time-honored terms, "myelogenous" and "lymphatic," (Ehrlich) for "lymphoid" and "myeloid" (Pinkus), or "lymphocytic" and "myelocytic," or better still, "myeloblastic" and "myelocytic" (Weber). There are two cells of importance, present in large numbers, and according to the presence of these the case is named. If the large non-granular mononuclear resemble a much enlarged lymphocyte it is lymphatic, lymphoid, lymphocytic, or, believing these to be the most primitive marrow cells, myeloblastic. If the granular mononuclear is the one increased, myelocytic. Concerning the latter cells most authorities are agreed. These large non-granular mononuclears have received a variety of names: large lymphocyte, non-granular myelocyte, lymphoid cell of marrow, myelocytoblast, myeloblast, premyelocyte, myelogonien, and undifferentiated leucoblast. We believe the sooner the term lymphocyte, and the compromise terms ending in "oid," are dropped, the better. These cells are round or oval in shape, with a relatively large nucleaus, round, oval, notched, or "bean"-shaped, poor in chromatin yet often with a good network, and a rather scanty protoplasm, more basophilic than the nucleus. The nucleus is often eccentric. They were first described by Fränkel in 1895 as characteristic of acute leukæmias. In this he was wrong, as others soon showed. They occur in all leukæmias. Somewhat similar cells are numerous in typhoid fever and malaria and perhaps are a constituent of normal blood if one takes the trouble to look for them. They are very fragile. They occur especially in acute leukæmia in large numbers. Januszkiewicz[49] says that no case of acute leukæmia is reported in which they did not predominate. It is possible that the cases with few present were only acute exacerbations of a chronic leukæmia, or that these cells were destroyed in the technic. Every transition from these to granular myelocytes occurs and the line drawn is only arbitrary. It may be that they are only an early generation of cell which later changes to one of the various granular cells, or perhaps to a red cell. It may be that in the myelocytic cases the descendants of these same cells which have changed to granular cells are increased; perhaps the disease attacks a different generation of bone-marrow cell. In favor of this idea is the greater anæmia which accompanies the former type (in this case only 750,000 reds) the absence of nucleated reds and other signs of regeneration. It is possible that the relative proportion of these cells is an index of the severity or rather profundity of the bone-marrow involvement, the myeloblasts predominating when the marrow lesion strikes at the root of the cell genesis, the myelocytes when the involvement is less fundamental. Of course the question of severity and duration of disease may not depend on the bone-marrow lesion alone. If this is true then some cases might change from myelocytic to myeloblastic as the disease progresses, and this seems to have occurred in Wilkinson's case,[50] and in v. d. Wey's.[51] Ehrlich, among his first papers on the blood, mentions a case in which toward the end non-granular cells seemed to replace the granulars "as if the ability to form neutrophile material was lost." Weber[52] reported a case "remarkable amongst cases of acute leukæmia on account of the great numbers of myelocyte-like cells present in the blood-forming organs, yet the greater proportion of colorless cells both in the blood and in the tissues belong to the lymphocyte type." He refers to acute lymphoid leukæmia as the most "primitive" type of leukæmia and the splenomedullary as the "most highly differentiated" of all. He gives a scheme of the leukæmias. Browning[53] considers the possibility that acute lymphoid leukæmia is the result of a reversion to the fœtal bone-marrow. He mentions the relative infrequency of myelocytic leukæmia in children. Fowler[54] reported the youngest, a child of five years of the acute "mixed" form.

But the line between the non-granular large lymphocyte and granular myelocytes is only arbitrary, depending on technic and on opinion. The former, even in the most beautiful specimen, may show none or all stages of granulation.

We have no intention of going into this question further. The discussions of these cells and this disease, whether always myelogenous or not, is found in Reed[55] and Kelly.[56]

The most interesting point to us is the demonstration of the fragility of so many leucocytes. The study of fresh blood and the use of the various methylene-blue eosin stains with methyl alcohol as fixative have taught us much concerning the large mononuclear cells, which are often as large as giant cells, and are found in all normal blood, but especially in typhoid fever and malaria. Grawitz has called attention to the fragility of these cells in the bone-marrow, considering that the "younger" the cell the more easily is it destroyed. Using Ehrlich's stain only unrecognizable blotches remain of these cells, as well as of the large macrophages of typhoid fever and malaria which are easily studied in the fresh specimens. Wolff states that using Romanowski's stains the large mononuclears are 10% instead of 2 to 4% as with Ehrlich's stain. Years ago Uskow emphasized the fact that in our ordinary leucocyte counts we lost some cells which go to pieces in the dilute acetic acid. We have given some attention to this point in normal bloods, but have found that the count with Toisson's is usually lower than with acetic, due we believe to the low dilution of the blood; since we try in a 1:200 dilution, in which the reds are preserved, to judge of 8000 leucocytes, counting 8 millimeter squares each averaging 4 cells, this means that the chance for error is enormous as the multiplier is so large; and the count will average lower, using Tois-

[49] Loc. cit.

[50] Lancet, 1903, I, p. 1739.

[51] Deut. Med. Wchs., 1896, p. 287.

[52] Trans. of the Path. Soc. of London, 1903, Vol. LIV, p. 286.

[53] Lancet, 1905, II, p. 507.

[54] Internatl. Clinics, 1903, Vol. III, p. 217.

[55] Am. Jour. Med. Soc., Oct., 1902.

[56] Trans. Assoc. Am. Phys., 1903, XVIII, p. 481.

sen's fluid, since the danger is of overlooking lymphocytes, than in a smaller count made with acetic acid, where lymphocytes are counted and but a few large mononuclears dissolved. But this case offered us a good opportunity to put the point to the test; hence the writer made careful leucocyte counts from drops of blood taken at the same time, using in one case dilute acetic acid, in the other Toisson's fluid. The counts were as follows: using dilute acetic 677,000 per cmm.; using Toisson's fluid, 880,000. Hence 203,000 leucocytes per cubic millimeter must have disappeared in the acetic acid mixture. Since the "large lymphocytes" were so greatly in the majority it is fair to suppose that these cells disappeared. Wolff believes (but gives no case to illustrate the point), that this destruction of cells may be so great as to explain apparent remissions in an attack when actually there was a high count of these cells. A few years ago we attempted to settle this question from a different point of view in a case of chronic myelogenous leukæmia with ascites. Our endeavor was to "grow" these cells artificially so as to watch their development. While the ascitic fluid was being drawn off, blood counting pipettes were filled exactly as if for a blood count at a dilution of 1:200, taking the blood from the ear, and instead of acetic acid using the ascitic fluid as diluent. Six pipettes were thus filled under as sterile conditions as possible, sealed and placed in a thermostat at blood temperature. On successive days the pipettes were well shaken and the blood cells counted, then the tubes resealed. Smears were also made, stained, and studied, with a view to determining which cells disappeared first. This test was not satisfactorily finished owing to the press of other work, but we were sure the cells to remain longest were the "fragile" red cells, especially the nucleated reds and these were grouped as if they had multiplied. Other small mononuclears were abundant, some polymorphonuclears, but what pleased us especially was to find some large mononuclear neutrophiles well preserved, showing that these cells at least are not so fragile as might be supposed. Nevertheless it is not at all strange that a fluid which will lake easily all non-nucleated red cells should be destructive to these young leucocytes with large vesicular nucleus containing little chromatin and so very sensitive to other reagents.

CASE II.—*A case of acute (myelogenous?) leukæmia, resembling a septicæmia, with leucocytes almost all achromatophilic.*

R. B., age 27 years; male; white, watchman; Gen. No. 55,828. Admitted Aug. 3, 1906. Died Aug. 16, 1906. Clinical diagnosis: Acute mixed leukæmia with typhoidal course.

The patient complained of "fever."

His family history was negative.

The past history was uneventful; he had always enjoyed good health. As a child he had measles, mumps, and whooping cough, but he never has had scarlet fever, diphtheria, pneumonia, rheumatism, chorea, tonsillitis, or malaria. He had no symptoms pertaining to the eyes, ears, nose, or throat. He denied headache, dizziness, or any nervous trouble before the present illness. Five years ago he had a cough of eight months' duration, with slight expectoration, though not bloody, without night sweats, and which did not influence his general health. He denied any gastrointestinal symptoms, such as nausea, vomiting, abdominal pain, diarrhœa, bloody stools, mucus in stools, etc. His appetite had always been excellent, and his digestion good.

His genito-urinary history has been negative, without venereal infection, and with no pain or frequency of micturition. He denied any skin eruption at any time.

His habits have always been good, and, so far as alcohol is concerned, he drank only an occasional glass of beer or whisky. His average weight was 187 pounds.

Present illness.—The patient stated emphatically that his present illness began acutely eleven days ago, with general malaise and pain in the limbs. On the next day the pain in the limbs was worse, he had no appetite, and yet he worked. On the fourth day he gave up work, feeling very sick, with griping pains just above the navel. He felt still worse on the fifth day and his physician gave him a purge, since which time he has had ten or more movements a day, none of them bloody. He has had no chills, or chilly feelings, but he has sweat profusely. He had no nose-bleed, no cough, no nausea, no vomiting, and no headache until admission.

Such is the story as told by the patient and by his wife. Just before his death, however, on questioning her more closely, we learned that during the past year the patient had frequently complained of headache, "weak spells," and "fever," and hence was frequently off duty.

Physical examination, August 4, 1906.—(The following notes are very much condensed from the original reports). The patient lay comfortably in the dorsal decubitus. His expression was bright and animated; there was no pain. The tongue was quite clean. The pupils reacted actively to light and accommodation, the external muscles balanced well. The pulse was 84 to the minute, and was not dicrotic.

Lungs.—The right lung was clear on auscultation and percussion in front and in axilla. Over the left front there was slightly diminished resonance, distant breath sounds, and many fine crackling and sibilant râles. Over both backs the percussion note was about equal, the breath sounds were distant, and the râles similar to those in left front.

Heart.—The point of maximum impulse was in the fifth interspace just inside the nipple line. There was a soft systolic blow over the body of the heart, but no accentuation of the pulmonic second sound.

Abdomen.—The abdomen was rather distended; it was symmetrical. Areas of pigmentation caused by two mustard plasters covered the epigastric angle and the umbilical region. The liver dulness began at the upper border of the sixth rib in the right mammary line, and extended to the costal margin. The spleen could be felt, but palpation was very difficult. The area of splenic dulness was not increased. There was dulness in both flanks. The patient perspired profusely; the profuse sweat had a very sour odor. There were no rose spots. The shins were clear, and there was no œdema of the ankles.

Blood examination.—Red cells, 4,300,000; leucocytes, 12,000; blood pressure, 95 mm. Hg. (systolic).

The temperature on admission last evening was 104°: to-day it fell to 101° and then rose again to 104°. The pulse has varied from 80 to 104, and the respirations from 20 to 28. The patient passed but one fluid stool and 370 ccs. of urine. The Diazo test was negative, and the Widal test was negative. On this day we doubted the diagnosis of typhoid fever with which he was admitted, and suspected septicæmia of some sort. The blood cultures made to-day remained sterile.

August 5.—At 3.30 a. m. to-day the patient complained of griping "cramp-like" pains just above the navel, each pain being of moderate severity, lasting about one minute and recurring every 10 or 15 minutes. Each pain was accompanied by the desire to defecate. His expression was now (5.30 a. m.) free from anxiety; he was sweating profusely. There was no change in tempera-

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ture or pulse, no nausea, no vomiting, and no pain on micturition or on defecation. The abdomen was full, its movements on respiration good. There was slight rigidity and some tenderness on the right side, as also some tenderness above the umbilicus, but no muscle spasm. Leucocytes, 12,400. These pains recurred at intervals during this day. The bowels moved four times; the stools were negative. He was nauseated at 6.30 p. m. and several times later, but did not vomit. The abdomen became (7.30 p. m.) slightly fuller than in the morning, but its respiratory movements were good. On the right side of the abdomen there was slight muscle rigidity, especially in the iliac fossa, but no muscle spasm, and little pain on deep pressure, except just above the umbilicus where pressure also caused the desire to defecate. There was no pain on defecation or urination. The liver dulness was the same as before: the dulness in the flanks was distinctly shifting when the patient rolled on his side. The sibilant râles were now universal throughout the lungs. At the fifth right interspace in front and at the base of the right axilla, the percussion note was impaired, the breath sounds were distant, yet not tubular, and the râles were quite numerous. The pulse varied from 80 to 104 and was very dicrotic; the respirations, from 20 to 28, and the temperature, from 101° to 104°. There had been six fluid stools and he had voided 1100 ccs. of urine. Cultures made to-day from the urine remained sterile. Leucocytes, 21,000; no malaria parasites found. We now asked ourselves if it might not indeed be typhoid fever admitted with some abdominal complication.

August 6.—On this day a few petechiæ were found over the manubrium, otherwise the signs were unchanged. The temperature ranged from 102.6° to 103.9 ; the pulse, from 84 to 120 and was dicrotic; the respirations, from 20 to 32. He passed five stools, and 2220 ccs. of urine. Leucocytes, 21,800. The Widal test on this day was again negative.

August 7.—On this day the patient was much nauseated and vomited repeatedly. The edge of the liver was much more easily palpable and more tender on pressure, especially at the gall bladder region, suggesting a cholecystitis. The rectal examination was negative. The temperature ranged from 102.5° to 104.1°; pulse, from 96 to 120; respirations, from 24 to 28. There were to-day three stools and 2590 ccs. of urine. The number of leucocytes was 33,000.

August 8.—To-day the spleen measured 4 cm. below the costal margin, and the liver, 1.7 cm. A definite friction rub was heard at the base of the right axilla. The temperature varied from 102° to 103.1°; the pulse from 96 to 120; the respirations from 24 to 28. He voided 3390 ccs. of urine, and had two stools. The Widal test was negative for the third time. Leucocytes, 56,000. The increase in size of the liver, the tenderness along its edge the friction rub over its lateral surface, together with the other signs of a pyæmic process, suggested liver abscess so strongly that we obtained his consent to an exploratory operation. But at just this point attention was attracted to the blood picture. Hasty examination had suggested a polymorphonuclear leucocytosis, but now we began to try to make an accurate differential count. Leucocyte count, 56,000.

August 9.—The nausea still continued. To-day there were found at each elbow an infiltrated area which suggested a chain of large lymph glands, but was probably a diffuse lymphocytic infiltration. The other lymph glands were not enlarged. There was a fresh crop of purpura in the lower left axilla. The temperature varied from 100.6° to 103.1°; the pulse, from 100 to 120; and the respirations, from 20 to 32. There were to-day six stools, and 3080 ccs. of urine. The ward physician to-day reported that he had used up a whole box of cover slips trying to get a well-stained blood specimen and had failed. The nearest that could be ascertained was: Polymorphonuclear cells, 41%; large mononuclears (granular and non-granular), 44%; small mononuclears, 10%. This statement at once suggested the diagnosis of acute leukæmia, which an examination of the fresh and poorly stained specimens confirmed. The subcutaneous injections of arsenic were begun at once. Leucocyte count, 64,800.

August 10.—The patient to-day expectorated one ounce of bright blood. There was now definite jaundice. A fresh crop of fine petechiæ had appeared over the trunk. The hypodermic punctures were surrounded by a wide area of hæmorrhage. One submucous hæmorrhage was found inside the mouth on the cheek. A coarse-friction was now heard also in the left axilla. The temperature had ranged from 101.6° to 103.6°; the pulse, from 90 to 110; and the respirations, from 20 to 32. There had been five stools, and he had voided 4950 ccs. of urine.

Blood examination.—Red blood cells, 4,464,000; hæmoglobin, 88%; leucocytes, 86,000.

August 11.—The patient was drowsy and complained of pain in the lower abdomen and back. There was a necrotic area of the gum at the base of the lower central incisor teeth. There was a loud, leathery-friction rub in both axillæ and in the backs as high as the angles of the scapulæ. Sonorous râles were heard throughout both chests. Otherwise the signs were the same. The temperature ranged from 101.1° to 103°; the pulse, from 100 to 124; and the respirations, from 24 to 36. He had one stool and passed 2060 ccs. of urine. The leucocytes were now 83,100.

August 12.—The general condition remained much the same, but at times, when left alone, he was irrational; at other times, when aroused, his mind was clear. The pulse was of small volume and low tension, 100 to 124 a minute; the temperature ranged from 100.6° to 102.6°: the respirations, from 32 to 44. The diffuse bronchitis and extensive pleurisy persisted. The heart sounds were clear. The petechial eruption in the back was fading. The leucocytes were now 122,000.

August 13.—The condition continued about the same. The temperature ranged from 100.6° to 102.4°; the pulse, from 100 to 124; the respirations, from 30 to 40. He had 11 stools, and passed 1630 ccs. of urine. The leucocytes were 123,000.

August 14.—The patient seemed weaker. The temperature varied from 101.4° to 103.1°; the pulse, from 88 to 120; and the respirations, from 30 to 44. The patient had 11 stools, and voided 1815 ccs. of urine. The leucocytes were 168,000.

August 15.—There was this day some cyanosis, and some dyspnœa. A scattered crop of small purpuric spots had appeared on the face, neck, arms, and back. The heart sounds were much weaker; there was embryocardia. The shifting dulness in the flanks had increased; there was some œdema of the ankles. The temperature ranged from 100.6° to 102.1°; the pulse, from 100 to 120; the respirations, from 28 to 48. He had four stools and passed 1490 ccs. of urine.

Blood examination.—Red cells, 4,600,000; hæmoglobin, 95%; leucocytes, 147,000.

August 16.—The pulse was dicrotic. The jaundice had become deeper. There was some oozing of blood from the mouth. New petechiæ appeared on the forehead, arms, and axillæ. The bronchial râles persisted, the pleural friction was very loud, and there was a louder pleuropericardial rub at the apex of the heart. The œdema of the legs increased. The patient was at times restless, at times irrational, and at times mentally clear. At 9 p. m. to-day he died suddenly. The temperature rose from 101° to 104.4° at death; the pulse varied from 96 to 144; the respirations, from 36 to 40. The bowels had moved five times, and 1220 ccs. of urine were passed before death. The leucocytes this morning were 184,000.

Autopsy, August 17, 1906, 10 a. m. No. 2757.

Anatomical Diagnosis.—Acute ulcerative enteritis and colitis; perforation of ulcer; localized peritonitis; acute suppurative bronchitis and bronchopneumonia; acute hæmorrhagic pleuritis; acute mitral endocarditis; splenic tumor; subserous hæmor-

rhages; acute nephritis; general anæmia; pyoid bone marrow. (The following report is much condensed from the anatomical records.)

The body was well nourished. There was some post-mortem settling of blood to the dependent parts. There were numerous minute subserous hæmorrhages over the intestines, mesentery and parietal peritoneum. The hepatic flexure of the colon was kinked upon itself; the coils were adherent by recent organized exudate. On attempting to separate these coils one opened into the bowels through the thin floor of an ulcer.

The left pleural cavity contained a slight excess of fluid, and the pleura of the left lung was covered by an acute hæmorrhagic and fibrinous exudate. There was a similar exudate over the posterior portion of the right lung. The pericardial cavity appeared to be normal except for a few small hæmorrhages on the surface of the heart.

The heart weighed 300 gms., the right side being much dilated by soft post-mortem clots, which were light brownish-red in color, but without a greenish tinge. The valves were normal except on the mitral flaps at the line of closure there were numerous small translucent nodules, the largest of which stands 3 mm. above the surface of the valve. . . . . The heart muscle was pale, opaque, and rather soft.

Lungs.—These presented numerous hæmorrhages under the fibrinous exudate above mentioned, which were most marked at the posterior portion of the left lower lobe. This lobe on section was deeper in color (than the upper), was moist, and contained numerous areas of hæmorrhage and numerous projecting miliary nodules, which were airless and on pressure yielded a small drop of pus. The bronchi contained purulent material. Otherwise, the lungs were normal (save for the pleurisy above noted).

The spleen weighed 360 gms. and measured 16 by 10.5 by 5 cm. It was adherent to the diaphragm by a fairly fresh fibrinous exudate, and was mottled in appearance with areas of purplish-red and brownish-red. On section the organ was mottled. The trabeculæ was obscured by the increased pulp. The pulp was of a light reddish-brown color with numerous smaller dark red areas running through it. The Malpighian corpuscles were not sharply marked off from the pulp, but they were enlarged. The organ was considerably softer than normal. In it was a firm wedge-shaped, grayish-white infarct.

The liver weighed 2050 gms. and measured 29 by 20 by 8.5 cm. Its surface was uniformly smooth and pale, and its edge rounded. Otherwise, it was negative.

The stomach, pancreas, bladder, genital organs, and aorta all were negative.

The kidneys were similar in appearance. The left one weighed 200 gms. and measured 14 by 5 by 5 cm. The capsule stripped off easily, leaving a mottled surface with some injection of the vessels, and numerous minute hæmorrhages. On section the cortex measured 1 cm. in width, and was somewhat opaque, the striation being regular and sprinkled with numerous small hæmorrhages.

The tonsils were somewhat enlarged, but were otherwise negative.

Intestines.—Throughout the length of the large intestine were numerous ulcers. In the cæcum they were more or less rounded. They had fairly undermined edges with clean base, often on the muscularis. There were several in the cæcum which measured 6 to 15 mm. in diameter. The solitary follicles appeared also enlarged and showed small central ulcerations. As one reached the transverse colon the ulcers appeared very ragged. They extended transversely, but chiefly longitudinally, with well defined borders. The floors were fairly clean, but contained a small amount of blackish, necrotic material. This ulceration extended as far as the rectum. In the lower end of the ileum were numerous similar ulcers giving it a worm-eaten appearance. As one passed up the ileum these diminished in numbers till they were shallow and about 5 cm. in diameter. In the lower ileum they seemed confined to the Peyer's patches, but there was no indication of a preceding hyperplasia of the follicles. There were no signs of miliary tubercles on the floor of any ulcer. The mesenteric lymph glands were swollen and had on section a uniform grayish-pink appearance. There was in them no sign of necrosis or caseation.

The bone-marrow of the femur was soft, and of a reddish-gray color, while that of the vertebræ and ribs was similar, but had a more marked reddish-gray, almost pyoid, appearance.

Microscopic notes.—In the lungs were areas of hæmorrhage and areas in which the alveoli were filled with polymorphonuclear leucocytes and some fibrin.

In the liver lobules the cells at the center showed some atrophy. The portal spaces were infiltrated with cells chiefly of the large mononuclear type, but some were polymorphonuclears.

The spleen was extremely cellular. The pulp was infiltrated with cells chiefly of the large mononuclear type. The Malpighian corpuscles were small and quite distinct from the cellular pulp.

The lymph glands showed some hyperplasia, the germinative centers being prominent.

Kidney.—The epithelial cells of the convoluted tubules were swollen, very granular and almost filled the lumen. Some tubules showed the presence of red cells about the glomeruli and larger vessels. There were accumulations of cells similar to those in the portal spaces of the liver. There appeared to be no marked increase in connective tissue.

The bone-marrow of the femur was chiefly fatty, except that in the periphery and about the larger vessels there were accumulations of cells chiefly mononuclear in type, although polymorphonuclear cells were quite numerous. Some mitotic figures were found among these cells.

Dr. Whipple, after studying this marrow in carefully prepared sections, made the following note: "It is a moderately cellular marrow, in which, however, a large percentage of the fat remains. The predominant cells are indifferent cells, there are very few eosinophile cells and giant cells, and only a fair number of nucleated reds. The most unusual feature is the proliferation of fibroblastic tissue in the immediate neighborhood of the small blood vessels."

Intestines.—In the small intestine the Peyer's patches were hyperplastic and showed an ulcerated surface, as well as hæmorrhages into the deeper parts of the patches. The cells were largely of a lymphocyte type, although cells of a larger type were present in considerable numbers, while the polymorphonuclears were fewer. Very few phagocytes or lymphocytes were found.

All the vessels of the various organs showed an unusual number of nucleated cells, especially of the large mononuclear type.

This, then, was a case of continuous fever, admitted on the eleventh and with death on the twenty-fourth day of the disease. That the fever was a continuous one may be judged from the fact that he was given ice sponges every third hour, if the temperature was 102.5° or over, and, although fifty of these were given during the fourteen days, yet not once did the temperature fall below 100.5°.

Among other general features were the absence of any mental symptoms until the very last, and then he was only slightly irrational and but for short periods. Until the last day he was at no time dull and stupid, that is, typhoidal, but always bright and clear-minded. He was without pain if we exclude the abdominal cramps early in the disease. He sweat profusely much of the time, a very sour-smelling sweat,

yet unaccompanied by chilly feelings or fluctuation of temperature.

On admission the diagnosis of typhoid fever was tentatively made awaiting the results of blood culture and the Widal test, which were repeatedly negative. Very soon a septic condition was suspected; the negative Widal test, high temperature, rapid pulse, profuse sweats, leucocytosis, clear intellect so common in streptococcus septicæmia, all suggesting this. But what infection? through what protal of entry? Miliary tuberculosis and malignant endocarditis were discussed. On the eleventh and twelfth days the cramp-like pains in the upper abdomen, which had begun on the fourth day, hence before admission, made us very anxious, fearing that the condition might be after all typhoid infection with intestinal perforation. But these pains and the physical signs accompanying them were never indications clear enough for exploration. Yet, as autopsy showed, intestinal perforation really did occur. There was a perforation of the bowel and local peritonitis, which condition resembled a perforated typhoid ulcer so closely that it required microscopic examination of the tissue to decide the question.

On the 15th, 16th, and 17th days the symptoms-complex was that suggesting abscess of the liver. To the general features of septicæmia and diarrhœa were added an enlargement of the liver, pain on pressure over its margin, and then the appearance of a diaphragmatic pleural friction rub over its lateral surface. We then gained his consent to operation and would have proceeded had the blood condition not been discovered on that day. This case was more suggestive of liver abscess than was that of Sondern and Mendelson:[57] their case had colicky pains suggesting gall-stone colic radiating from the epigastrium, and tenderness at the hepatic notch: pains not unlike those of our case. Unfortunately no autopsy was obtained in their case. In our case as in Sondern's the pains antedated the hospital admission, but by three weeks rather than one. Kelly[58] reports a case of acute lymphatic leukæmia actually admitted to the hospital for operation for abscess of the liver. This patient had the general septic features, and a large tender liver. The ileum showed large infiltrated ulcerated necrotic Peyer's patches resembling typhoid ulcers. He suggested that even autopsy might not always clear up the diagnosis, for typhoid fever may be the anatomical as well as the clinical diagnosis, and in our case typhoid fever was the anatomical diagnosis before the sections were studied microscopically. Thompson and Ewing's case[59] was admitted with abdominal pain, nausea and vomiting. Gordon's[60] had a tender liver, and Gordinier's case suggested a local abdominal trouble. We thought of gastric or duodenal ulcer, but not seriously, although the pain might have suggested it, and the septic features did indicate a perforation. Had he had bloody stools this diagnosis might have been considered seriously, which happened in the case reported by Elder and Fowler[61] where bloody stools alone were the basis of that diagnosis. Stevens' case[62] resembled this case clinically since he also excluded typhoid fever, tuberculosis, malignant endocarditis, and then a septicæmia. His case had the same duration, three weeks, and in both the enlargement of spleen and lymph glands began on about the thirteenth day. They differ in that his had resistent, painful priapism, and the lymph glands increased rapidly in size. Januszkiewicz[63] reported a case which anatomically was in several respects similar to ours, with enlargement of the solitary follicles of the intestines and of the Peyer's patches with superficial hæmorrhages into these.

We believe that the disease could be considered acute, since there was a definite onset eleven days before admission. It is true that he was a little below par during the preceding year, and this has been true of several cases recently reported as acute. But we do not believe this to be an acute exacerbation of a chronic leukæmia. The low count and small spleen on admission are against that. Sondern's case was "inclined to chlorosis since youth" with slow convalescence from fevers.

The onset was that of an acute fever. He had not the throat, or mouth symptoms, nor the enlarged glands, nor the hæmorrhages which so often occur in acute leukæmia, nor was prostration his only symptom. Lazarus[64] states that nearly all cases of acute myeloid leukæmia begin with a mouth or throat infection; ours did not.

His pulse was rather rapid, often dicrotic, of good volume and tension, and the heart practically negative, except toward the end when embryocardia was present.

During the whole course he had a general bronchitis, then on the 16th day a very local pleurisy in the right axilla which soon, on the 19th day, covered both axillæ and much of both backs. As might be expected the respirations became more and more rapid.

At no time was there general glandular enlargement. The tonsils were never enlarged; there was no nasal obstruction, no superficial evidence of enlarged thymus. The posterior and anterior cervicals were just palpable, that was all, until the seventeenth day when were found the infiltrating masses on the inner aspects of both elbows. The liver was at first not enlarged, on admission reaching just to the costal margin, but after the fifteenth day it reached 1.7 cm. below, and was distinctly tender. One cannot say whether or not the spleen was just palpable at first since the abdomen was too rigid for satisfactory palpation, but the edge was not felt nor the dullness increased. On and after the sixteenth day it reached 4 cm. below the costal margin and was very easily felt, hence we are sure had definitely enlarged.

Among the gastro-intestinal features may be mentioned the pains mentioned above, while the shifting dullness in the flanks was a constant and worrying sign. The tongue was very clean at first, and until the eighteenth day. He had often

[57] New York Med. Jour., 1905, Vol. 82, p. 1154.
[58] Loc. cit.
[59] Med. Rec., 1898, Vol. 53, p. 333.
[60] Loc. cit.
[61] Edinb. M. J., 1904, XVI, p. 502.
[62] Lancet, 1905, I, p. 153.
[63] Virchow Arch., 1903, Vol. 173, p. 309.
[64] Deut. Med. Wch., 1905, Vol. XLII, p. 1209.

nausea but no vomiting until the fifteenth day. The diarrhœa was a most troublesome symptom.

The urine of the first two days after admission was normal in amount, of specific gravity 1010, amber color, clear, with no sugar, a good trace of albumin, a few granular casts, and a few pus cells. The Diazo test was negative. After that the total amounts were saved for chemical work.

The hæmorrhagic features were never striking. The first petechiæ were seen on the fourteenth day on the neck, then on the chest, back, arms, and legs. They were small, from 2 to 3 mm. in diameter, never numerous, and might easily have been overlooked. Around the punctures for subcutaneous injections however a subcutaneous hæmorrhage spread for 2 or 3 cms. One or two subcutaneous hæmorrhages appeared in the mouth, and a necrotic area at the base of the middle lower incisor teeth. On the eighteenth day he expectorated about one ounce of blood. Jaundice appeared on the fourteenth day. It was never more than a faint tint.

The eyes, throat, and ears were negative.

Blood.—Red cells. The point most interesting in this case is the absence of severe anæmia. On admission the red cells were 4,300,000. The count rose somewhat later, perhaps due to diarrhœa, but at least there was absence of any great blood destruction, for at the end the count was 4,600,000. There was, therefore, none of the "anæmia progressive and severe" (Billings and Capps), so constant a feature of acute leukæmia. This was, we believed, evidence in favor of its belonging to the myelocytic group, for in the chronic cases this form is not associated with as severe an anæmia as is the lymphocytic; nevertheless if acute myelogenous leukæmia one would expect a more severe anæmia than if chronic myelogenous.[a] This high blood count may throw light on the nature of the two forms of acute leukæmia. Granting both to be myelogenous one supposes that in the lymphoid form the myeloblasts, *i. e.*, the large lymphocytes, predominate (see page 76), in the other the myelocytes (the same cells further differentiated with granular protoplasm). Hence, in the latter, cells of a later generation are involved. It is supposed that these same indifferent cells (large lymphocytes) are directly related to (if not the same as) the parent cells of red corpuscles. It is clear, therefore, if this be true, that in the acute lymphoid type the formation of red cells would be more affected, and so the red count lower, than if the white series was affected at a point below the branching off of the red series. In 14 cases of probably acute myelogeonus leukæmia collected from literature the lowest red counts varied from 2,500,000 to 256,000; mean count 1,500,000. The highest count on admission was 3,132,000. As is seen, no case was found with so high a count as ours.

The red cells were quite normal in appearance, they stained well, there was little poikilocytosis and degeneration. A few normoblasts were found and the early discovery of a typical megaloblast suggested the diagnosis of leukæmia.

In the chronic spleno-myelogenous leukæmia megaloblasts are very common, in the lymphatic, rare. In 8 cases reported of acute myelocytic leukæmia nucleated reds were present in 5, in one 2618 normoblasts per cubic millimeter, and megaloblasts in 2.

The leucocyte count, 12,000, on admission made us doubt that the condition was typhoid. Its constant rise caused repeated search for some pus focus, probably in the liver until the count reached 56,000. Up to that time only the fresh blood had been hastily examined and a polymorphonuclear leucocytosis assumed. But when the count reached 64,800 we made a determined attempt to get a differential count and it was then that the diagnosis was made from the interne's report that the leucocytes would not stain. During the next few days over one hundred futile attempts were made to get a blood film suitable for a differential leucocyte count. For the most part Ehrlich's triple stain was used, but also Hasting's methylene-blue eosin stain, also hæmatoxylin and eosin. Films were heated on the copper bar at the boiling point for periods of from ten minutes to seven hours; others at the spheroidal point for periods of from a few seconds to two hours; others were passed through the flame; the alcohol-ether, the formalin-alcohol, and the methyl-alcohol methods of fixation were also tried. Some films were soaked in ether, others in alkali, others in acid, before heating, and for some smears the blood was diluted with normal salt solution. The results were nearly all about the same; the specimen looked hazy as if seen through a dirty lens; the red cells were always deeply stained, and, except in specimens subjected to very high temperatures, or heated for a long time, were always overstained as if underfixed. That is, after heating even six hours at the boiling point the red cells were of a deep claret color. The nuclei of the lymphocytes were well stained, and as a rule more deeply than normal, but the protoplasm was hardly distinguishable it stained so faintly. A few well-stained polymorphonuclear neutrophiles were found, but of the majority the protoplasm stained a diffuse pale dirty pink and no granules could be made out, while the nuclei stained well, a dark bluish-green, but at times a sea-green. Only two or three polymorphonuclear eosinophiles were seen and these were well stained. In a specimen fixed with methyl-alcohol and stained with Ehrlich's triple stain three typical eosinophile myelocytes were found. Of the large mononuclears and large cells with notched nuclei, the nuclei were for the most part poorly defined and of a light bluish-green color. Of some the protoplasm was uncolored but for the most part took a color from pale pink to a deeper dirty pink. Other films were saved five weeks before fixing, but these gave no better results.

The fresh blood specimens showed a mononuclear leucocytosis, the predominant cell being the large lymphocyte. Many looked perfectly clear of granules, but in the fresh some were clearly granular. These former are the well-known "large lymphocytes" (see page 76). We might suppose that the most of these were non-granular; if so, the case was one of "lymphatic" leukæmia. But that is by no means certain.

[a] Elder and Fowler, loc. cit.

Until the Ehrlich stain was introduced all these were considered as clear cells but Ehrlich showed some of them to be granular and named them myelocytes. It takes a good stain to show the granules of these cells and with the best stains one must count a large number as cells of uncertain nature since it is a matter of technique and of personal opinion whether they are really granular or not.[66] In cases of acute lymphoid leukæmia these cells stain beautifully, nuclei and protoplasm especially in the methylene-blue mixtures while the more differentiated granular cells stain more poorly. The almost uniform refusal of these cells to take any stain may or may not be in favor of the latter. Of the cells which could be recognized a few cells were surely mononuclear neutrophiles and three were eosinophile myelocytes. But the great majority of the leucocytes were represented by a blur in which it was hard to tell the shape of the nucleus or the nature of the protoplasm. The possibilities are the following: first, we may imagine the cells were too young to stain well. Grawitz emphasized the fragility of the young marrow cells. Uskow had shown this also. Special technique is usually necessary to stain embryonic cells. But if so there were surely plenty of older cells which would have stained well, which was not the case. Second, the cells might have been degenerated, undergone lytic processes, to use Wolff's expression. Wolff[67] gives no case to illustrate his points concerning this process. He merely states that, due to lytic processes, often many of the leucocytes won't stain, and since destruction may be as rapid as new formation there may be no apparent increase in leucocytes. The modifications of Romanowski's stain alone, he says, will usually stain these but not always, and in our case this certainly was true. Degenerating cells usually stain beautifully, and surely in our case a few would have been caught when not too degenerated to stain. One might suppose that in our case with the count rapidly rising there would be enough young cells which would take a good stain and allow a fairly interesting differential count, but this was not the case. A very good argument could be written in favor of this degenerating theory, for Weber showed in his case a preponderance of granular myelocytes in the marrow and of non-granular lymphoid cells in the blood. All stages are always found in the blood between granular and non-granular myelocytes. In nearly all cases of lymphatic leukæmia about one-tenth or more of the leucocytes are surely degenerated.

We do not believe this achromatophilia was due to a special quality of the leucocytes but to the blood as a whole, perhaps the chemical nature of the plasma. Our reasons are, that this achromatophilic quality was not of one group but of all; that in some specimens islands stained well, and here a few of all groups of cells could be recognized; and lastly, the red cells stained as if underheated. Specimens were heated for all possible lengths of time hoping to strike the right point, but even extreme heat gave the same picture. We do not believe technique at fault since the stains were well tested, and all modifications of fixation used.

Since so few cells were recognized it is impossible to say what variety of leukæmia it was and yet we suspect it was myelocytic since so many of the cells which could be definitely recognized were granular cells, and of these three were eosinophile myelocytes. When we remember how long one must hunt in well-stained specimens of lymphocytic leukæmia for an eosinophile of any description this occurrence of three myelocytes with those granules would suggest a myelocytic blood. There were also found nucleated reds, normablasts, and a megaloblast, which are rather rare in the lymphocytic form.

Of course a few granular cells do not make the case myelocytic. But in this case the cells whose nature was most easily determined were nearly all granular. Of 12 cases in literature grouped as myelocytic the large lymphocytes varied from 17 to 76%; the small mononuclears, 0 to 34.5%; the neutrophile myelocytes from 10.6 to 60%. Nevertheless the study of the bone marrow is quite in favor of the diagnosis lymphoid leukæmia.

The refusal of the cells to take a stain is our reason for reporting this case. We could find no case in literature just like this, hence report it as a case with almost all the leucocytes quite achromatophilic.

CASE III.—*A case of acute leukæmia (?) with leucopenia, "aplastic leukæmia."*

R. G., age 19 years; female; white; worker in a "sweat shop"; Gen. No. 54419. Admitted April 9, 1906. Died April 15, 1906.

Clinical diagnosis.—Alymphæmic lymphomatosis; or acute pseudoleukæmia; or aplastic anæmia.

The patient was admitted complaining of "headache and giddiness."

The family history was almost negative; both parents were living and well, as were also seven brothers who were all well but one, and he was "short of breath with a little cough," with sputum, which was never bloody. The maternal grandmother died of tuberculosis.

The past history was almost uneventful. As a child she was strong and well, and of all children's diseases had only measles. She never had typhoid fever, malaria, pneumonia, pleurisy, scarlet fever, or diphtheria. As a child she had a bad earache with a discharge, which was not followed by deafness. She never had a chronic cough, no gastro-intestinal symptoms, and no urinary symptoms. She began to menstruate at 14 years of age and had regularly until the past month. She was working hard in a sweat shop under the most unhygienic surroundings.

The present illness began gradually one month ago, with headache and giddiness if she rose suddenly, and on walking. She had not fainted, and had no nausea or vomiting, and no hæmorrhage of any sort. She had been growing paler and had noticed some small lumps in the neck. They were not tender and had had been growing smaller. This headache and giddiness grew worse till April the 2d, when she gave up work and consulted a physician who told her she had mumps, so swollen were her posterior cervical glands. He told her to remain in bed. She remained there two days and then tried to get up, but became very dizzy and for a time blind. Two days ago another doctor was called, who found her very anæmic, with a swollen pale left tonsil, enlarged glands behind the ears, and large glands in the groins and axillæ. He sent her here. [Johns Hopkins Hospital.]

On *physical examination* she presented a striking picture. She

[66] See Billings and Capps, Am. Jour. Med. Sc., 1903, Vol. IX.

[67] Berl. Klin. Wchs., 1905, Vol. XLII, p. 35.

was of large frame and fairly well nourished. The skin was almost white, was moist, and there was no skin rash.

The mucosa of the lips could hardly be distinguished from the skin; she resembled a cadaver. The scleræ were pearly blue.

The tongue was extremely pale and thinly coated.

The teeth were in excellent condition. There was no evidence of bleeding from the gums.

The tonsils were large, especially the right, which was somewhat inflamed, and hence was in striking contrast to the rest of the throat which was very pale. In the crypts were several white cheesy plugs.

The eyes were myopic, and the eyelids were puffy; the fundi and discs were very pale; there were fresh hæmorrhages in each eye.

The vessels of the neck were all full and all the veins pulsated. The thyroid was not enlarged.

The posterior cervical, mastoid, and submaxillary glands were all enlarged, and formed visible tumors. Some of these were 1.5 to 2 cm. in diameter. Those in the anterior triangle were palpable. The enlarged glands were not tender. In both axillæ were very large glands (one was 2 by 3 cm.). The epitrochlears were palpable, about the size of peas. The inguinal glands were about 1 cm. in diameter.

Thorax.—The lungs were clear throughout, except a loud, leathery pleural-friction rub in the right lower front. The heart's point of maximal impulse was in the fourth interspace, 7.5 cm. from the midsternal line. Relative cardiac dulness was not increased. There was at the apex a rough systolic murmur not heard in the axilla; otherwise the sounds were clear. The pulmonic second was accentuated. The pulse was 108 to the minute, very quick and collapsing, of moderate force and tension. The vessel walls were not palpable.

The spleen descended fully 3 cm. below the costal margin in inspiration. Hepatic dulness began at about the fifth interspace, and its edge was easily palpable.

The shins were clear, and the reflexes normal.

Blood, April 9.—Hæmoglobin, 16% (Fleishl); red corpuscles, 1,144,000; white corpuscles, 3800; large mononuclears, 43%; small mononuclears, 39%; polymorphonuclear neutrophiles, 14%; eosinophiles, 1%; myelocytes, 0.2%; unidentified, 2.5%.

One normoblast was found in counting 500 leucocytes.

April 11.—White corpuscles, 3600.

April 12.—Hæmoglobin, 18%; red corpuscles, 940,000; white corpuscles, 3700. Blood cultures taken to-day remained sterile.

April 14.—The patient looked even more exsanguine. There was now a faint yellow tint to the scleræ, but the face and body showed none of the saffron hue, or lemon-yellow tint seen in the primary pernicious anæmia. The glands were diminishing somewhat in size. Under the left clavicle the breath sounds were rather harsh, and many clicking râles were heard following inspiration. A few râles were heard down the left front and axilla. The pulse was distinctly water-hammer in quality, and the wave audible with the stethescope even at the wrist. Respiration was deep and rapid as if "air hunger" were present. The relative hepatic dulness began in the right mammary line at the upper margin of the sixth rib, and extended to about 3 cm. below the costal margin. The spleen now could only just be felt; it was much smaller than on admission. On the lower extremities were seen many subcutaneous hæmorrhages, which were on and below both knees and on the dorsum of the feet. The palms of the hands and soles of the feet were of an orange hue. The shins were clear; there was no œdema of the ankles; the reflexes were normal. The Widal test was negative.

April 14.—The patient was suffering from marked air hunger and from frequent attacks of nausea. There was a loud friction rub in the left back, and the right axilla and back.

Blood examination.—Red corpuscles, 724,000; hæmoglobin, 13%; white corpuscles, 1920.

April 15.—The patient died early this morning, with marked respiratory distress. She looked completely exsanguine.

The urine varied from 620 to 2250 ccs. in 24 hours, and its color was pale yellow though slightly turbid. The specific gravity was from 1011 to 1017, the reaction acid, with no sugar, no albumin, and only a few squamous (vaginal) epithelial cells in the sediment.

The temperature was continuous, between 101° and 103° at times, reaching 105° on one occasion. On these days the variations of the two-hour chart were not over one degree. The pulse ran exactly parallel to the temperature, from 120 to 130, and the respirations varied from 24 to 28. The most interesting feature of this case was the constancy of temperature, pulse and respiration.

Unfortunately no autopsy could be performed.

When this case was admitted we confidently expected to find it one of acute leukæmia, but to our surprise leucopenia was present. There were all the general features of acute leukæmia; the severe anæmia, the cachexia, the hæmorrhages, the general glandular enlargement, the large liver and large spleen; but the leucocyte count was only 3800 per cubic millimeter, 1630 of which were large mononuclears, 1500 small mononuclears, 530 polymorphonuclear neutrophiles, 38 eosinophiles, 7 myelocytes, and 95 unidentified. There was even the pleural friction rub not rare in acute leukæmia. What was very interesting was the dimunition in the size of lymph glands, liver, and spleen, simultaneous with the drop in the red and leucocyte counts. The course was fairly acute, not over five weeks at the longest.

Cases somewhat similar to this have been reported under a variety of names, among which are: acute pseudoleukæmia, acute Hodgkin's disease, lymphatic pseudoleukæmia, aleukæmic pseudoleukæmia, sublymphæmic lymphomatosis, aleukæmic leukæmia, aplastic leukæmia, and chloroma. Unfortunately no autopsy was obtained, hence the most important evidence for a diagnosis could not be obtained.

Pseudoleukæmia is a most convenient term. It means a condition itself not clear, which simulates leukæmia and yet is not. It can be anything else providing the resemblance is striking and that anything else is itself without better diagnosis. It was used for Hodgkin's disease until this was shown by Reed to be a distinct condition; of many cases of tuberculosis adenitis until the introduction of the tuberculin reaction; of cases of splenomegaly until splenic anæmia and Banti's disease were separated; of lymphosarcoma and malignant lymphoma until the practice of removing glands for diagnosis was common (and now the pathologists may sometimes be wrong). All that is left is a theoretically possible group of cases which clinically resemble leukæmia; that is, they have severe anæmia, cachexia, weakness, the hæmorrhagic diathesis, often the enlarged lymph glands, liver and spleen, and yet a leucocyte count, normal quantitatively and qualitatively. Some go one step farther and say that the histological picture of the marrow should be that of leukæmia. We believe this last specification is too stringent and doubt if any such case is on record (Reed). The word pseudoleukæmia

would then have lost its value and a better name could be given to so exact a clinical and anatomical picture. By pseudoleukæmia all we mean is that, go as far as we can, although this may not be far, as in this case, the condition resembles leukæmia and yet is not, since the blood picture is absent. But there is always a chance that the blood picture was formerly leukæmic or later will be, and it is because we cannot exclude these possibilities that we use this term. The term pseudoleukæmia is a confession of our ignorance. We are quite sure, for example, that a case which is now Hodgkin's disease never has been and never will be leukæmia except as a condition new to that patient.

But ours was not a case of acute pseudoleukæmia, since the blood formula was anything but normal, was, in fact, truly leukæmic, with over 1600 cells per cubic millimeter of a group not represented in normal blood at all. We did not remove a gland for microscopic examination, hence cannot be sure that it was not Hodgkin's disease, although the blood formula would exclude that also. Also it is indeed rare in Hodgkin's disease for the lymph glands to recede.

Hand[68] reported a case of aleukæmic leukæmia in a boy two and a half years old. He was admitted six weeks after the onset with swollen feet, puffy eyelids almost closing the eyes, with subcutaneous, submucous, and subconjunctival hæmorrhages, epistaxis, and hæmatemesis. The liver reached 6 cm. and the spleen 3 cm. below the costal margins. The lymph glands were generally enlarged. The red cell count was 1,390,000, hæmoglobin 23%, leucocytes 6300 (small lymphocytes 85%, large 4.75%, polymorphonuclears 8.85%). Unfortunately there was no autopsy.

Ours could have been a case of acute lymphatic leukæmia at a later stage, for Holst[69] reported one the successive counts of which were 93,000, 130,000 (large lymphocytes 96%, polymorphonuclear neutrophiles 3.10%, small lymphocytes 0.9%), 58,000, and one day before death, 1600 (polymorphonuclears 50%, large lymphocytes 10%, small lymphocytes 40%).

Jeanselme and Weil[70] report an interesting case of three weeks' duration with leucocyte count, 4400, polymorphonuclears 22%, small mononuclears 58.5%, large mononuclears 15%, plasma cells 4%, but with the marrow of acute leukæmia. Neumann (also Wolff and Pappenheim) believed that in leukæmia we have a process which can attack the spleen, liver, lymph glands, or the bone-marrow. So long as the first three organs are affected the blood remains normal and the condition is a pseudoleukæmia. When first the bone-marrow is invaded, the hard inelastic bony capsule forces the sarcomatous tissue to invade the vessel walls and hence cells press into the blood current, and leukæmia begins. So long as the endothelium of the vessels is still intact the condition is "alymphæmic pseudoleukæmia";[71] while the entry of cells into the blood stream is only slight, "sublymphæmic lymphomatosis," the lymphatic pseudoleukæmia of Pinkus; when many cells press in, the condition is "lymphatic leukæmia."[72] According to this scheme our case with normal count yet large numbers of large lymphocytes would be one of "sublymphæmic lymphomatosis." Wolff[73] reports a case under the heading "aplastic leukæmia" which resembles our Case III in many ways. He states that there was aplasia of bone-marrow but qualitatively the changes were those of lymphatic leukæmia. The liver was large (six fingers breadths below the costal margin), the spleen small, a few glands were slightly enlarged, and the leucocytes varied from 3000 to 5000. The anæmia was severe and progressive, reaching 500,000 red cells. Wolff says we can recognize aplastic leukæmia intra vitam by the large percentage of large lymphocytes together with the low total count, and especially by the progressive severe anæmia without signs of regeneration. If no large lymphocytes are present one can still make the diagnosis from the relatively large number of lymphocytes. Our case would certainly correspond to this blood picture, for the mononuclear non-granular cells were 82% of the total 3800 leucocytes, and of these 43% were large, while the anæmia in our case was certainly severe enough. But unfortunately we do not know what the bone-marrow looked like.

Aplastic anæmia is very similar to aplastic leukæmia if one judge from the blood alone. A recent case will illustrate this. The woman, 48 years of age, had had a typhoid fever of terrible severity and with many complications including hæmorrhages, thrombus of axillary vein, bed sores, pleurisy with effusion, acute lobar pneumonia and a psychosis. After all this hard course we were congratulating ourselves that recovery was now possible, the temperature remaining normal, but it seemed as if the blood could not regenerate. The red cells had fallen from 4,448,000 to 2,500,000 and then 1,582,000; the hæmoglobin from 55% to 37%, to 25%; and the leucocytes at three times were 4000, 6200, and 5300. It seemed as if the bone-marrow had failed utterly to replenish the blood, hence no new cells were furnished, and the anæmia progressed as the old were removed. She died on the 95th day of the illness, and 22 days after the temperature had reached normal for the last time. We have seen severe malaria behave in a somewhat similar manner.

A diminution in size of lymph glands, liver, and spleen coincident with the fall in the count is sometimes reversed as in a case of acute lymphatic leukæmia in the wards a few years ago. The patient was seen in September with large

[68] Arch. of Pediatrics, Dec., 1905.

[69] Loc. cit.

[70] Pédiat. prat., 1904, II, p. 52; and Bull. et mém. d. Soc. méd. des hôp. de Paris, 1904, XXI, p. 185.

[71] Türk, Wien Klin. Wchs., 1903, Vol. 16, p. 1073.

[72] See Banti, Centralb. f. Allgem. path. und path. Anat., 1904, Bd. 15, p. 1.

[73] Berl. Klin. Wchs., 1905, Vol. XLII, p. 35.

glands but normal blood, and a diagnosis of Hodgkin's disease made. He was admitted December the 25th with the lymph glands much smaller, and the leucocyte count 133,400. His course was very severe with hæmorrhages, and he died January 19 with the white count about the same, but the lymph glands smaller still. In this case as the count rose the visible hæmatopoietic organs diminished in size. Kuhnan and Weiss[74] report a case in which also this point was present.

All things considered we think, in the absence of an autopsy, that "acute aplastic leukæmia" is the best diagnosis we can make.

[74] Zeitsch. f. Klin. Med., 1897, Vol. 32.

THE NECESSITY OF A MORE UNIFORM NOMENCLATURE OF DISEASES FOR STUDY AND TEACHING.[1]

By THOMAS MORGAN ROTCH, M. D.,

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To the physician in general practice, whose busy days are spent in the care of the sick and their treatment, it matters little whether or not a practitioner in some distant city calls a disease by the same name as he, according to his locality or to his previous instruction, is accustomed to and satisfied with. To him, also, it is of little moment whether a number of different diseases which he meets with are called by the same name. It not only does not matter to him, but even the suggestion that the terms which he is using are meaningless and incorrect is met with mild scorn as a subject too trivial upon which to waste the time and thought of one whose life is made up of honest endeavor and untiring work for the relief of suffering humanity. If, however, he would but think for a moment, and look at the question from a little different point of view, he might at least be willing to aid those who are endeavoring to untangle a labyrinth of misleading words which, as mere relics of past ignorance, clog the wheels of progress, in that they do not represent the great advances which have been made in the medical knowledge of the present day. He would then also see that many of the ancient titles mean the ancient supposed knowledge of what are now known to be exploded theories, and that to use them means the unnecessary continuation of false ideas. But even if such a practitioner should be willing to acknowledge that he had been giving a number of different diseases the same treatment because he had learned to classify them under one name, he would naturally draw attention to the fact that physicians in general throw all the responsibility of names upon the instructors whom, in the various universities, they have paid to teach them how to diagnosticate and treat diseases and that in receiving that instruction they rightly look to the instructor to at least give them the correct name under which they are to carry out such instruction. Still further, if, attracted by the name and experience of a medical author, he should purchase a book to instruct him, he expects from the index to turn to the page where the disease he is seeking light on is under its own definite heading. It never occurs to him that that very heading is a delusion and a snare, the use of which is unworthy of the brain which has evolved the perhaps brilliant description of the disease which follows. If it is allowed that his reasoning is correct and that such an unfortunate state of affairs actually exists, he will then probably understand how important a matter it is for the curing of disease and the saving of life in his own practice, to join with those who would force upon the attention of instructors and authors that their work is but half done when their teaching is stultified by a false nomenclature.

It is, however, these very teachers who realize, as no one else can, the difficulties which arise when they attempt to study and make use of the writings of others who from their experience are fully competent to throw light on a given subject, and yet whose investigations become doubtful and obscure because the uncertainty is always arising as to whether under the name of the disease they are describing they mean one or a number of diseases, or because they are using a different name for the disease than is used by the one who is seeking information, and who, therefore, hesitates to accept such information. If the teacher finds difficulties arising in his investigation of a subject owing to his not understanding the latest work of others on that subject, how much is the difficulty increased when he endeavors to impart the latest knowledge to the student, for he feels that he is not doing justice to the subject, and knows that the student needs correct names to aid him in grasping the true relationship of diseases to each other. What I have just said, though in the main true, is, of course, greatly exaggerated, and exaggerated purposely to show what may occur under certain instances and what in the future will inevitably occur more frequently unless we adopt a more uniform and rational nomenclature. It is especially for the sake of the medical student, the general practitioner, and ultimately the patient, that by means of systematic headings, approved and adopted by the leading centres of teaching, diseases should be studied and referred to under uniform headings representing exactly what is known about them.

I have for many years been impressed with the belief that the subject of a classification for clinical purposes was an

[1] An address read by invitation of the Johns Hopkins Medical Society at the Johns Hopkins Hospital, January 7, 1907.

important one, and one which ought to be dealt with by teachers, as they can best appreciate the value of such a subject. The pathological classification has year by year been changed and improved and kept up to the later researches by the pathologists; the terms for physical diagnosis have been revised and improved by the clinical teachers, but the nomenclature of diseases has not kept pace with our knowledge of them.

The revision of a classification is extremely difficult, the difficulties being especially realized by those who have attempted it. In 1894 Dr. Forchheimer and myself, as a committee of the American Pediatric Society, presented a classification of Diseases of the Mouth in Early Life. It was adopted by the Society and went no further than to appear in our own books. In the same year Dr. Holt and myself presented a classification for Gastro-Enteric Diseases in Early Life on partly an anatomical and partly a clinical basis: it was not accepted. In the following year, however, I felt so firmly that it should be adopted that I brought it up again and it was passed by the Society, but with some strong opposition. I immediately had it introduced into the teaching of the Pediatric Department at Harvard where it has been taught ever since. It was never used to any extent by individual members of the Pediatric Society or anywhere else.

It is a curious fact that the profession clings to old names by preference. It has seemed to me self-evident that to really make any headway in a classification, the great teaching centres, such as Baltimore, Philadelphia, New York, Chicago, and Boston, should work together and agree on provisional classifications which can be changed from time to time according as any new etiological discoveries warrant us in so doing.

A uniform classification means uniform teaching: it means that Johns Hopkins can come to Harvard and Harvard to Johns Hopkins for an additional degree without the applicant being handicapped by such an unnecessary obstacle as not understanding the terms used in his examination, resulting from the teachers in the two universities using different terms, perhaps satisfactory to themselves, but puzzling for the student.

Even if only a beginning could be made by reclassifying one or two subjects where it was needed most, much good would come of it, for the teachers would then understand what great practical aid would result from an advanced classification for the clinical work in all diseases. With this idea in view I have in conjunction with my colleagues in the Pediatric Department at Harvard made a new classification of Gastro-Enteric Diseases in Early Life on an etiological basis, believing that no classification of these diseases can be made satisfactory for clinical work excepting from an etiological standpoint. This classification has been approved by the American Pediatric Society and adopted by the Pediatric Department of Jefferson. I believe, however, that for any permanent good which can come from it, it should be criticized and mutually revised by the different universities; and then if satisfactory to all, brought into universal use as an example of what can be done. Those who teach the clinical medicine of the different periods of life, whether it be infancy or childhood, adult life or old age, should each present for the approval of the others the classification for the period of life which they are especially studying and teaching.

I think that after I have spoken in detail of this classification which I am presenting to you to-night, that you will agree with me that a classification when possible should be on an etiological basis. We believed this 14 years ago, but at that time found it impossible and therefore were forced to place our classification partly on an anatomical and partly on a clinical basis, which, however, was a great advance on the old and unmeaning names used before.

In endeavoring to bring the teaching centres to agree on a uniform classification, we should present, first, a *primary* classification the details of which can later be worked out by the individual teacher and perhaps finally adopted by all. If at first we go beyond this primary classification, my experience tells me that we shall fail to come together. The sample classification, therefore, which I am about to give you, must be considered primary or approval of its etiologic basis will not be universally given.

Although the diseases of the gastro-enteric tract form perhaps the most important division of pediatrics, there is none in which there is so much confusion and diversity in the terminology employed. Almost every clinical condition is described by a number of different terms, some of which are relics of obsolete theories and others the products of modern research. As an example of this multiplicity of synonyms, one clinical condition in infancy is spoken of by the following different names: summer diarrhœa, acute gastro-enteric intoxication, gastro-intestinal catarrh, gastro-enteritis, cholera infantum, mycotic diarrhœa, fermental diarrhœa and acute intestinal indigestion. This confusion is a source of difficulty both to students and to those engaged in scientific research. The student, in order to study intelligently the work of various observers who employ a varying terminology, must burden his mind with many synonyms. The investigator has difficulty in describing his results in terms which shall be generally intelligible.

Much of the difficulty is due to the fact that at no time has the classification of these diseases been founded upon any definite basis. Such terms as gastritis, ileocolitis, and catarrh are based upon pathologic anatomy; other terms, such as indigestion and nervous diarrhœa, are based on etiology; while still others, such as gastralgia and diarrhœa, are merely names of symptoms. In the classification adopted by the American Pediatric Society in 1894, the gastric and enteric disorders respectively were first divided into functional and organic on an anatomic basis. Then the functional disturbances were divided into acute and chronic on a clinical basis, while the organic diseases were divided into inflammatory and non-inflammatory on an anatomic basis. The further subdivisions of these groups were made usually on an etiologic basis.

These three bases, the clinical, anatomic, and etiologic, are all employed in the classification of diseases in general, in the

endeavor to fit clinical descriptions to postmortem findings, and to etiologic factors. The clinical basis is obviously unscientific, and should only be adopted in those diseases which have neither a well-recognized etiology nor a constant pathologic anatomy. This is not the case with the diseases of the gastro-enteric tract, many of which have a recognized etiology. Classification on an anatomic basis is absolutely impossible from the fact that while some conditions show no anatomic changes on postmortem examination, others show a great variety of changes, and a marked lack of correspondence between the clinical picture and postmortem findings. Diseases of widely different etiology and symptomatology may show the same changes postmortem, while diseases of a constant etiology and symptomatology may show postmortem conditions varying from no demonstrable lesion to the very gravest.

So strongly has this been impressed upon me, especially when I have undertaken to teach the students at Harvard what we know concerning diseases of the gastro-enteric tract in infancy and early childhood, that before attempting to describe the etiology and symptoms, I at once speak of the anatomical findings as a whole.

I show them how much is known by the pathologists—how carefully described and classified pathologically are the lesions which may be found postmortem in the gastro-enteric tract—I tell them that, with comparatively few exceptions, it is impossible to tell clinically whether any or all of these lesions are present, and that as the pathologist has in a number of cases been unable to give us an anatomical picture to correspond to the etiology they clinically are of little use to us. I then present to them for inspection some of these lesions found in young subjects, without corresponding symptoms, so as to impress upon them that to name the diseases after these lesions is misleading—that is, the lesion must always be one of the secondary details in a nomenclature of the gastro-enteric tract.

I will show a few of these lesions on the screen, but it is of course to be remembered that they are of early life and therefore are the more likely not to be accompanied by corresponding clinical symptoms. They represent a great variety of intestinal lesions and are impressive as suggesting that a number of causes may produce any one of them and that no one cause has been found to produce them all; also that grave as are many of these lesions, they in no way aid in the diagnosis and so far as naming the disease anti-mortem is concerned are entirely without value.

The following lesions were then shown on the screen:

No. I. *Girl*, 8½ *Years*.—TUBERCULAR ULCERS OF COLON. 2 months before death, chills; temperature, 103°; prostration. Diarrhœa showing nothing. Nothing on physical examination except enlarged glands. *Post mortem*, lungs normal; large sloughing ulcers of cœcum and colon. Tubercle bacilli found.

No. II. *Girl*, 2¾ *Years*.—TUBERCULAR ULCER—SMALL INTEST. Diarrhœa occasionally for a year and convulsions. No lesions which could be determined during life.

No. III. *Girl*, 2 *Years*.—TYPHOIDAL ULCERS OF COLON. MARKED THICKENING AND ULCERATION OF PEYERS' PATCHES AND OF SOLITARY FOLLICLES.

In this case the irregularity of the temperature curve and the prominent symptoms of cerebro-spinal irritation rendered the diagnosis of typhoid so obscure that it was not suspected until a few days before death.

No. IV. *Young Infant*.—HYPERPLASIA OF LYMPH FOLLICLES.

Lesions marked and simulate closely the hyperplasia of Peyers' Patches seen in typhoid; only slight diarrhœa.

No. V. *Girl*, 3 *Years*.—NON-ULCERATIVE FOLLICULAR INFLAMMATION. SIMPLE HYPERPLASIA OF LYMPH FOLLICLES.

Symptoms; excessive vomiting following improper food. No intestinal symptoms. Death in 5 days.

No. VI AND VII. *Boy*, 2 *Years*.—NON-ULCERATIVE FOLLICULAR COLITIS. Solitary follicles enlarged, most prominently in upper third of intestine; no ulceration; Peyers' Patches markedly swollen.

Continued high temperature, 104° F. Slight diarrhœa, 2 weeks; discharges showing nothing marked. Symptoms mostly of cerebral type, and abdominal symptoms not prominent.

No. VIII. *Infant* 16 *Months*.—ULCERATIVE FOLLICULAR COLITIS. No tubercular lesions found. Extensive follicular ulcerations of colon.

Occasional attacks of diarrhœa for 3 months. No other marked clinical symptoms.

No. IX. *Girl*, 3 *Months*.—ACUTE ULCERATIVE CATARRHAL COLITIS. Lymph follicles enlarged but not ulcerated. Colon showed numerous ulcerations, which were simply necrotic.

Emaciated and fretful. No vomiting. Temperature normal or sub-normal. One large yellowish-green movement daily.

No. X. *Girl*, 3 *Months*.—INFLAMMATION OF FOLLICLES AND SURROUNDING PARTS OF COLON WITH EXTENSIVE ULCERATIONS OF COLON. PROCESS HAD GONE ON TO NECROSIS.

No acute symptoms; 6 to 8 greenish, loose discharges in 24 hours; slight vomiting. Temperature, 95° to 101°. Failed and died in about 5 weeks.

No. XI. *Boy*, 6 *Months*.—CHRONIC CATARRHAL ULCERATIVE FOLLICULAR COLITIS. PIGMENTED FOLLICULAR ULCERS OF COLON.

No especial abdominal symptoms. Wasted away and died in a few days after entering hospital.

No. XII. *Child*, 3½ *Years*.—PSEUDO-MEMBRANOUS COLITIS, confirmed by microscopic examination. Other organs normal (entire length of colon affected). Much reduced after pertussis. Diphtheria, and for 10 days a slight amount of diarrhœa, but no pain or tenesmus.

These cases show how inadequate are symptoms not only for the diagnosis of lesions, but often how insufficient are they to even enable us to diagnosticate any lesions whatever.

The modern tendency is toward an etiologic basis of classification. The progress of bacteriology is constantly separating certain clinical pictures, and labelling them with the name of the specific causative agent. Therefore, it would seem advisable, if possible, to classify the diseases of the gastro-enteric tract upon an etiologic basis. It is not possible to use terms which in every case suggest the etiology, as certain conditions have been so long known by definite names which cannot be discarded. But it is possible to choose among synonyms that name which is most suggestive of the etiology. More important still, it is possible to arrange these diseases in definite

groups, on an etiologic basis. The following classification is suggested:

DISEASES OF THE GASTRO-ENTERIC TRACT.

- **Gastric**
  - Developmental — Malpositions, Malformations . . . . Pyloric stenosis.
  - Non-Infectious
    - Mechanical . . . . Contraction, Dilatation.
    - Ulcers . . . . . Peptic.
    - New growths.
    - Functional . . . . Nervous vomiting, Recurrent (periodic) vomiting, Indigestion.
    - Traumatic . . . . . Corrosive gastritis.
  - Infectious . . . Gastritis.
- **Enteric**
  - Developmental — Malpositions, Malformations.
  - Non-Infectious
    - Mechanical . . . . Dilatation of colon, Volvulus, Intussusception, Hernia, Fissure, Prolapse, Hæmorrhoids.
    - New growths.
    - Functional — Incontinence, Constipation, Nervous Diarrhœa, Indigestion — Duodenal, Intestinal — Deficient secretion, Fermentation.
  - Infectious . . — Infectious diarrhœa — Dysentery, Cholera infantum, Other organisms; Proctitis, Appendicitis, Fistulæ.

Intestinal worms.

The diseases are divided into three groups, developmental, non-infectious, and infectious. The further subdivisions of the non-infectious groups are based as far as possible on the origin of the condition. The conditions of mechanical and traumatic origin need no further explanation, nor do the new growths and peptic ulcer. The word functional is used, not as in the old classification, to mean the antithesis of organic, but rather to mean that the origin of the disease is a disturbance of function, from various causes. Nervous diarrhœa and nervous vomiting suggest nervous influences. Recurrent or periodic vomiting is a definite clinical type of an origin which, though unknown, is probably definite. Indigestion means disturbance of the function of digestion, in either the stomach, duodenum, or intestine.

The term gastritis, although an anatomic one, is retained, for the reason that there is no satisfactory synonym suggesting the etiology.

On the other hand, the term ileocolitis is discarded as being inappropriate for the name of a disease. Ileocolitis is found postmortem in a great variety of different clinical conditions. Moreover, certain cases in which ileocolitis is found have been relegated to the category of such specific infections, as typhoid fever and tuberculosis. The term infectious diarrhœa is chosen as most suitable for describing the infections of the intestine, for the reason that it suggests both the etiology and the principal symptom.

Under the diseases of the stomach there will be found a close and obvious fitting of the clinical picture to the term used in describing it. Under the diseases of the intestine it was necessary to subdivide the cases of indigestion into duodenal and intestinal, in order to fit well-recognized clinical types. The acute duodenal indigestion represents the well-known clinical type often spoken of as catarrhal jaundice, or gastroduodenitis. Chronic duodenal indigestion is the clinical type usually spoken of by the same name, with its characteristic clinical symptoms of nausea, occasional vomiting attacks, abdominal pain, loss of weight, coated tongue, prominent abdomen, and clay-colored movements.

In the division of intestinal indigestion, it is necessary to further subdivide into two clinical types, the primary cause of which is the same, disturbance of the digestive function. In the first type the symptoms are due to simple functional disturbance, the secretions being deficient, or at least insufficient to perform the work required of them, with consequent diarrhœa from irritation of undigested masses. This type, from deficient secretion, is characterized by an absence of toxic symptoms, especially of fever, and by movements containing curds, or undigested masses, but not notably foul. In the second type the symptoms are due to deficient secretion plus bacterial fermentation. It is characterized by the frequent occurrence of brief initial fever and toxic symptoms, and by green movements of foul odor.

A clear distinction is drawn between those cases which show fermentation from saprophytic bacteria in the intestinal contents, and those in which there is true infection of the tissues with parasitic bacteria. The former cases may show serious symptoms as the result of toxic absorption, but are nevertheless due primarily to disturbance of the digestive function, and are, therefore, classified as the fermentation type of intestinal indigestion. The latter cases are classified under the heading infectious diarrhœa.

The cases classified as infectious diarrhœa clinically resemble true infections. They are characterized by persistent fever, with its attendant symptoms, and by the frequent early appearance of blood and mucous in the movements. From recent bacteriologic research it is probable that the majority of these cases are due at least in part to infection with the Bacillus dysenteriæ. Nevertheless, since it has not been proved that this organism is the sole etiologic factor in intestinal infection nor that it is causative in all the cases of this clinical type, the term infectious diarrhœa is preferable to infantile dysentery. The latter term may be reserved for those cases in which the finding of the Bacillus dysenteriæ in the movements, and of an agglutinin of this organism in the blood, proves that this organism is actually causative in the individual case.

Cholera infantum is so distinct and has been so long recognized as a clinical type that the term is retained as describing one form of infectious diarrhœa, the etiology of which, though still unknown, is probably a definite form of infection.

It is hoped that the classification suggested and outlined will prove advantageous both for teaching and for future scientific investigation; for teaching, because the student will need to carry in mind only certain definite etiologic groups. He must in any case know what is known of the etiology of these conditions. When he meets with a condition described under

a synonym, his knowledge of its etiology will at once enable him to interpret it correctly, and classify it properly. For convenience in teaching, conditions of similar anatomic and clinical descriptions, but different etiology, have been placed in such a way as to follow one another, and thus the distinctions between them can be made more clear to the student, without confusing his mind by describing a disease of entirely different symptomatology in between. Thus corrosive gastritis, of traumatic origin, follows immediately after indigestion, of functional origin, and is followed in turn by the gastritis of infectious origin. Also, the functional diseases of the intestine are placed immediately before the infectious, and their subdivisions arranged in such a way as to bring out sharply the distinction between the various forms of diarrhœa, the descriptions of which follow one after another.

It is hoped that this classification will be advantageous to the scientific investigator, because future investigation is to be mainly in the domain of etiology. The arrangement of the diseases of the gastro-enteric tract in definite groups, on an etiologic basis, separates at once those conditions of which the etiology is known, from those of which the etiology is partially or wholly unknown. This will simplify the description of the results obtained in the future.

I appeal to you who represent the most advanced ideas in medicine extant, and are looked up to as the source from which emanates the best medical teaching in this country, to aid your sister teaching centre—Harvard—to impress upon the teachers throughout the world the necessity of an advanced and uniform nomenclature.

BENJAMIN RUSH, AS MATERIALIST AND REALIST.[1]

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Dr. Benjamin Rush, of Philadelphia, was the most conspicuous of the American medical materialists of the eighteenth century. Born of English stock in Pennsylvania in 1745, at school under the Reverend Samuel Finley, the later head of Nassau Hall, then at Princeton itself under President Samuel Davies, he learned the rudiments of medicine from Dr. John Redman. Obtaining his medical degree in Edinburgh University, walking the London hospitals, and helped by Franklin to study in Paris, he returned to America in 1769 and became in turn professor of chemistry in the Medical College of Philadelphia, physician-general of the continetal army of the middle department, and professor of the institutes of medicine in the new University of Pennsylvania.

Subjected to the varying influences of Anglo-American deism, Scottish realism, and British and French materialism, Rush's philosophical remains range from an undergraduate transcription of the metaphysical system of Dr. Davies, and a translation at the age of seventeen of the *Aphorisms of Hippocrates*, to his *Thoughts on Common Sense*, and a final volume on the *Diseases of the Mind*. It was in regard to this last work that he made the interesting statement that the diseases of the brain should be watched, since they often produce discoveries of the secret powers of the mind; like convulsions of the earth, which throw up metals and precious stones, they would otherwise have been unknown forever.[2]

As in his speculations Rush was a living compromise between various divergent schools of thought, so in his numerous public activities he was a personal paradox: in politics a signer of the Declaration, yet a maligner of the military genius of Washington; in education an agent in bringing President Witherspoon to Princeton and President Nisbet to Dickinson, yet a philistine as regards the study of the classics; in philanthropy an opponent of capital punishment and of slavery, yet a believer in the most drastic measures to stamp out the yellow fever; in medicine a pioneer in psychiatry, yet the originator of a species of phrenology. The dual nature of the man is outwardly shown in his portrait, which represents him in a pensive and yet a self-conscious attitude, his head in his hand but one eye cocked on the observer. So, from his works and his looks Rush may be judged to be rather profuse than profound,—a hard-headed philosopher, dealing in what he was pleased to call the practical metaphysics of the mind. Mere theories did not disturb him. When at Edinburgh he was thrown with David Hume, but no traces of that subtle sceptic are to be found in his thought. At home he received from Jefferson a confidential copy of the *Syllabus of the Doctrines of Jesus*,[3] but that did not shake his orthodox beliefs.

In a word, Rush was an eclectic. He took what he wanted and left what he did not like. Consistency was not his, for he was influenced in turn by deism, realism, and materialism. The influence of the first appears in the teleological trimmings of his system, the moral bearings he gave to his physiology and psychology. Like Hartley, he was not content with examining man's frame, but extended his observations to his duty and his expectations. Likewise in his realism the good doctor was wont to pick and choose. For common sense he found use at first rather in a political than in a philosophical sense. He had suggested the term as a title for Thomas Paine's revolutionary pamphlet of 1775, but by 1791 he writes that he had long suspected the term to be

[1] A chapter from a forthcoming volume on American Philosophy, read at a meeting of the Johns Hopkins Historical Club, December 10, 1906.

[2] Purnell MS., p. 50.

[3] Jefferson Works, Ford. ed. 8, 223. Letter to Rush, April 21, 1803.

applied improperly to designate a faculty of the mind.[4] Here he will not repeat the accounts which have been given of it, from Cicero and Berkeley to Hobbes and Hume, but will confine himself to differing with Reid's account of the matter. Instead, then, of considering it a faculty or part of a faculty, possessing a quick and universal perception of right and wrong, truth and error in human affairs,—he will define it simply as opinions and feelings in unison with the opinions and feelings of the bulk of mankind. From this definition it is evident that common sense must vary with the progress of taste, science, and religion. Thus it is contrary to common sense to speak in favor of republicanism in Europe or of monarchy in America; it is contrary to common sense to use opium, bark, mercury, or the lancet, but agreeable to it to revenge public and private injuries by wars and duels; common sense in Great Britain and the United States is in favor of boys spending four or five years in learning Latin and Greek, whereas it is contrary to right reason to teach them words before they are taught ideas. In fine, to say that a man has common sense, is to say that he thinks with his age and country, in their false, as well as their true opinions. After all that has been said in its favor, one cannot help thinking that it is the characteristic only of common minds. Had this common sense depended upon the information of the five external senses, one would have no difficulty in admitting Dr. Reid's account of it. But to suppose it the first act of the reason and afterwards to suppose it to be universal is to contradict everything that history and observation teach us of human nature. And yet in the progress of knowledge, when the exact connection between the senses and reason is perfectly understood, it is probable that the two will be in unison with each other, but this unison as in the case of vision—where the reason connects the distance of objects with the evidence of the eyes,—must be the result only of experience and habit.[5]

To judge from this diatribe against the "doubtful faculties of taste and intuition,"[6] Rush must have suffered from that overdose of realism which he got in his undergraduate days and while a student at the Scottish capital. The reaction sent him over into the English materialism. The transition between the two is exactly marked by the title of his best known essay, the *Influence of Physical Causes upon the Moral Faculty*. Delivered before the American Philosophical Society in 1786, this exhibits a vocabulary borrowed from speculative Edinburgh, but an application suitable to utilitarian Philadelphia. The moral faculty, to borrow the term of Beattie, may be called the moral sense of Hutcheson, the sympathy of Adam Smith, the moral instinct of Rousseau, the regula regulans of the schoolmen; it may be a native principle, a capacity in the human mind of distinguishing good and evil, a faculty quick in its operations, and like the sensitive plant acting without reflection,—it may be all these things, and yet, at the same time, be subject to physical influences.

Do we observe a connection between the intellectual faculties and the degrees of consistency and firmness of the brain in infancy and childhood? The same connection has been observed between the strength as well as the progress of the moral faculty in children. Do we observe instances of a total want of memory, imagination, and judgment, either from an original defect in the stamina of the brain, or from the influence of physical causes? The same unnatural defect has been observed, and probably from the same causes, of a moral faculty. A nervous fever may cause the loss not only of memory but of the habit of veracity. The former is called amnesia, the latter unnamed malady will compel a woman, be she even in easy circumstances, to fill her pocket secretly with bread at the table of a friend.[7]

For instances and reasonings like these, drawn from his own experience and practice, Rush has been designated the father of psychiatry in America.[8] In venturing upon this untrodden ground the doctor confesses that he feels like Æneas when he was about to enter the gates of Avernus, but without a Sibyl to instruct him in the mysteries before him. He therefore begins with an attempt to supply the defects of nosological writers by naming the partial or weakened action of the moral faculty *micronomia*, its total absence *anomia*. But to name these derangements is not to explain them; they may be caused not only by madness, hysteria, and hypochondriasis, but also by all those states of the body which are accompanied by preternatural irritability, sensibility, torpor, stupor, or mobility of the nervous system. It is in vain to attack these accompanying vices, whether of the body or of the mind, with lectures upon morality. They are only to be cured by medicine and proper treatment. Thus the young woman, previously mentioned, that lost her habit of veracity by a nervous fever, recovered this virtue as soon as her system recovered its natural tone.[9] Furthermore, it makes no difference whether the physical causes that are to be enumerated act upon the moral faculty through the medium of the senses, the passions and memory, or the imagination. Their action is equally certain whether they act as remote, predisposing, or occasional causes. For instance, the state of the weather has an unfriendly effect upon the moral sensibility, as seen in the gloomy November fogs of England; so does extreme hunger, as in the case of the Indians of this country who thus whet their appetite for that savage species of warfare peculiar to them. Again, the influence of association upon morals is strong. Suicide is often propagated by the newspapers and monstrous crimes by the publication of court proceedings. And as physical causes influence moral, so do they influence religious principles. Religious melancholy and madness will

[4] Thoughts on Common Sense, p. 249.
[5] Ibid., pp. 251-4.
[6] Purnell MS., p. 81.
[7] Moral Faculty, pp. 6, 7.
[8] W. Pepper, Journal of the American Medical Association, April 26, 1890, p. 6, note 2.
[9] Moral Faculty, p. 26.

yield more readily to medicine than simply to polemical discourses or casuistical advice."[10]

In this presentation of the influence of physical causes upon the moral faculty, its advocate anticipates the objection raised to it, from its being supposed to favor the materiality of the soul. And yet he does not see that this doctrine obliges us to decide upon the question of the nature of the soul, any more than the facts which prove the influence of physical causes upon the memory, the imagination or the judgment. The writers in favor of the immortality of the soul have done that truth great injury, by connecting it necessarily with its immateriality. The immortality of the soul depends upon the will of the Creator, and not upon the supposed properties of spirit. Matter is in its own nature as immortal as spirit. It is resolvable by heat and mixture into a variety of forms; but it requires the same almighty hand to annihilate it, that it did to create it. It would be as reasonable to assert that the basin of the ocean is immortal from the greatness of its capacity to hold water, or that we are to live forever in this world, because we are afraid of dying,—as to maintain the immortality of the soul from the greatness of its capacity for knowledge and happiness, or from its dread of annihilation."[11] On another occasion and in a less figurative way, Rush strove to disentangle the popular confusion between these two concepts. The writers to whom he now specifically refers are Plato and Cicero, Locke and Priestley. Regarding the nature of the mind, he says, the two first suppose it to be immaterial and independent of the body. Locke supposes it to consist of a matter, exquisitely fine, and connected with the body; that it is incapable of existence without the body, but that it does not perish with the body. Priestley supposes that there is no such thing as a mind either material or immaterial. With this meager reference to the Northumberland advocate of the homogeneity of man, the student who took these notes passes with unconcealed delight to a doctrine apparently different from all the variant forms, ancient and modern. Dr. Rush, he explains, believes that the mind is immaterial, that it can exist independently of the body, and that there is no necessary connection between the immateriality and immortality of the mind, the one being a divine attribute, the other a divine gift."[12]

Returning from this digression, the immaterialistic materialist comes to a defence of his main proposition,—the universal and essential existence of a moral faculty in the human mind. He apologizes for presuming to differ from such a justly celebrated oracle as Locke, yet holds that the latter has confounded this moral principle with reason, just as Lord Shaftsbury has confounded it with taste, since all three of these faculties agree in the objects of their approbation, notwithstanding they exist in the mind independently of each other."[13] One may admit with Locke that some savage nations are totally devoid of the moral faculty, yet it will by no means follow that this was the original consitution of their minds. As well might we assert, because savages destroy their beauty by painting, that the principles of taste do not exist naturally in the human mind. It is with virtue as with fire. It exists in the mind as fire does in certain bodies, in a latent or quiescent state. As collision renders the one sensible, so education renders the other visible. It would be as absurd to maintain, because olives become agreeable to many people from habit, that we have no natural appetite for food, as to assert that any part of the human species exists without a moral principle, because in some of them it has wanted causes to excite it into action, or has been perverted by example. There are appetites that are wholly artificial. There are tastes so entirely vitiated, as to perceive beauty in deformity. There are torpid and unnatural passions. Why, under certain unfavorable conditions, may there not exist also a moral faculty, in a state of sleep, or subject to mistakes?"[14] Ending with one of the author's habitual rhetorical flourishes this passage leaves an impression of weakness. But while it makes the moral principle a poor thing, incapable of affecting positive results, leading to no where in particular, the suggestion as to artificial and vitiated tastes opened a fruitful line of inquiry, leading indirectly to the last and most important work on the diseases of the mind.

Having considered the influence of physical causes upon the moral faculty Rush next takes up "the influence of physical causes in promoting an increase of strength and activity of the intellectual faculties of man." Delivered as an introductory lecture to his students in 1799, it exhibits a growing tendency towards materialism, together with a more cautious avoidance of metaphysical speculations. The writer confines himself only to those agents which increase the quantity of mind, leaving the causes which lessen it to a later pathology. He then passes by the knotty questions of the theoretical nature of the mind, deeming it sufficient for his present inquiry to believe that all its operations are the effects of bodily impressions, a belief according with the axiom of the schools—"nihil est in intellectu quod non prius fuit in sensu."[15]

In employing the trite maxim of sensationalism and treating the mind as if it were a pint measure, the speaker is but adapting his remarks to the capacities of his hearers. Desiring to present facts intelligible to the youngest student of medicine, he brings in anecdotes which savor more of natural history than of mental philosophy. Such are the bits of information that Jonathan Edwards rode a trotting horse to stimulate his thoughts; that Joseph Priestley, in order to strengthen his faculties, used to write upon every subject which he wished to understand perfectly; that in republics mental vigor is increased by the frequency of general elections. In citing these miscellaneous cases with all their triviality Rush, nevertheless, has a serious purpose. It is to calculate the degrees of vigor, and the number and exility of motions

[10] Moral Faculty, pp. 42, 47.
[11] Ibid., p. 19.
[12] Purnell MS., p. 81.
[13] Moral Faculty, p. 17.
[14] Moral Faculty, pp. 15, 16.
[15] Intellectual Faculties, p. 88.

which the mind is capable of receiving. It is by the exercise of the body and the collision of our intellects, by means of business and conversation, that we impart to them agreeable and durable vigor. The effects of this action and reaction, in making addition to the intellects and knowledge, lead us to admit the assertion of Condorcet that the time will come, when all the knowledge we now possess will appear to the generations that are to succeed us, as the knowledge now possessed by children appears to us. . . . From what has been delivered, gentlemen, it appears that the enlargement and activity of our intellects are as much within our power as the health and movements of our bodies.[16]

This is the characteristic conclusions of an introductory lecture to the study of medicine. To judge from certain manuscript notes of one of the doctor's pupils the others resemble it in being full of wise saws and modern instances: *e. g.*, the brain is like the lower limbs, if exercised it lasts; as the body is stimulated by air, so the mind is stimulated by motives; the faculties may be compared to a well-organized government: the memory and imagination to the House of Representatives, the understanding to the Senate, in which the transactions of the House of Representatives are examined, the moral faculties to the courts of justice, the conscience to the court of appeals.[17]

The works of the Philadelphian thus far are popular and superficial. With their abundant illustrations, from classical allusions to local anecdotes, they bear out John Adams' estimate of Rush as an elegant and ingenious body, but too much of a talker to be a deep thinker.[18] But this stricture can only in a measure be passed upon the next production of Rush's middle period, the *Three Lectures upon Animal Life*. The author is here more modest in his claims, in proportion as he is more thorough in his results. He disclaims being the source of the great and original conception upon which they are founded, confessing that he has done little more than carry the hod to assist in completing a part of the fabric of which the foundations were already laid.[19] It was while a student in the University of Edinburg in 1766 that he heard Dr. Cullen deliver the opinion that the human body is not an automaton, or self-moving machine, but is kept alive and in motion by the constant action of stimuli upon it. This opinion, which Rush repeated in one of his own lectures as early as 1771, he now enlarges into three general propositions concerning the human body, namely: that every part of it is endowed with sensibility; that it is a unit, a simple and indivisible quality of substance; and finally, that life is the effect of certain stimuli acting upon the sensibility and excitability, which are extended in different degrees over every external and internal part of the body. These stimuli are as necessary to its existence as air is to flame. Included, moreover, in animal life are motion, sensation, and thought. These three, when united, compose perfect life. The term motion is here preferable to those of oscillation or vibration, as employed by Dr. Hartley in explaining the laws of animal life, because it is more simple and better adapted to common apprehension.[20]

To this modified materialism the American now proceeds to attach a peculiar form of realism. In opposition to the Hartleian leaning toward monism he sets a form of pluralism: man is not a machine whose parts, however complex, are homogeneous, but he is rather a number of entities acted upon by a variety of forces. Or as Rush puts it, in addition to the external stimuli like heat and light, and the internal like the action of the brain, and the pulsation of the arteries, there are the intellectual stimuli arising from the exercises of the faculties of the mind itself. Thus the imagination acts with great force upon the body, and the passions pour a constant stream upon the wheels of life.[21]

Like a good realist the author has hypostatized the faculties. Yet he does not leave them hovering in mid air as mere empty quiddites. To the mind of the materialist, thought itself is the effect of stimuli acting upon the organs of sense and motion. Furthermore, the exercises of the faculties of the mind have a wonderful influence in increasing the quantity of human life. They all act by reflection only, after having been previously excited into action by impressions made upon the body. This view of the reaction of the mind upon the body accords with the simplicity of other operations in the animal economy. Finally, common language justifies the opinion of the stimulus of the understanding upon the brain, hence it is common to say of dull men, that they have scarcely ideas enough to keep themselves awake. And so, contrary to the picture of the Indian character drawn by Rousseau, their vacant countenances are to be attributed to the effects of the want of action in their brains from a deficiency of ideas. Again, atheism does violence to the mental faculties by robbing man of his most sublime beliefs, abstracting his thought from the most perfect of all possible objects. This is demonstrated by the theophilanthropists, who, after rejecting the true God, have instituted the worship of nature, of fortune, and of the human race.[22]

In these curious illustrations of a quantitative conception of mentality Rush's psychology threatens to degenerate into a sort of arithmetic of the mind, for beside the minus side in his table of values there is the plus. Thus the whole animal machine may be set in motion by the love of money, as was shown in the Philadelphia panic of 1791, when speculation over the scrip of the United States Bank excited febrile diseases in three of the doctor's patients. Similar mental stimuli are furnished by political conditions; many facts prove animal life to exist in a larger quantity in the enlightened and happy state of Connecticut, in which republican liberty has existed

[16] Intellectual Faculties, pp. 114, 117.
[17] Purnell MS., p. 96.
[18] Works, 2, 427.
[19] Animal Life, Preface, p. v.
[20] Animal Life, pp. 5-7.
[21] Ibid., p. 6.
[22] Ibid., pp. 19, 20, 67.

above one hundred and fifty years, than in any other country upon the surface of the globe.[23]

These strange generalizations, concerning the larger aspects of animal life, do not prevent the author from taking up the smaller phenomena, the minuter influences in the psychic life. Speaking of slight sounds which it is not necessary should excite sensation of perception, in order to their exerting a degree of stimulus, he adds: there are a hundred impressions made daily upon the body, which from habit are not followed by sensation; the stimulus of the blood upon the heart and arteries probably ceases to be felt only from the influence of habit. It is unfortunate that we forget what passed in our minds the first two or three years of our lives. Could we recollect the manner in which we acquired our first ideas, and the progress of our knowledge with the evolution of our senses and faculties, it would relieve us from many difficulties and controversies upon this subject. Perhaps this forgetfulness by children of the origin and progress of their knowledge might be remedied by our attending more closely to the first effects of impressions, sensation, and perception upon them as discovered by their little actions, all of which probably have a meaning as determined as any of the actions of men or women.[24]

By piecing together the broken hints of his authorities, from Leibniz on minute perceptions to Reid on how the infant faculties begin to grow, Rush in a measure advances the genetic point of view. But that suggestive method is again unfortunately spoiled by a quantitative misconception. In his attempt to be precise the materialist verges toward an accurate arithmetic rather than a trustworthy psychology. In other words, the American realist, following the lead of the Scotch, has attempted to obtain a distinct and full history of the mind of the child; but the result is scarcely "a treasure of natural history." Nor is the succeeding disquisition, which seeks to establish the principle that animal life in every species depends on the same causes as in the human body. But what is of interest here is the cautious conclusion reached by the former dogmatist: From a review of what has been said of animal life in all its numerous forms and modifications, we see that it is as much an effect of impressions upon a peculiar species of matter, as sound is of the stroke of a hammer upon a bell, or music of the motion of a bow upon the strings of a violin. I exclude, therefore, the intelligent principle of Whytt, the medical mind of Stahl, the healing powers of Cullen, and the vital principle of John Hunter as much from the body, as I do an intelligent principle from air, fire, and water. . . . It is not necessary to be acquainted with the precise nature of that form of matter which is capable of producing life from impressions made upon it. It is sufficient for our purpose to know the fact. It is immaterial moreover whether this matter derive its power of being acted upon wholly from the brain, or whether it be in part inherent in animal fibers. The inferences are the same in favor of animal life being the effect of stimuli and of its being as truly mechanical as the movements of a clock from the pressure of its weights. . . . Should it be asked what is the peculiar organization of matter, which enables it to emit life, when acted upon by stimuli, I answer, I do not know.[25]

Notwithstanding his agnostic conclusion regarding man as a machine, Rush has something to say on the practical application of his doctrine to metaphysics and morality. It enables us to reject the doctrine of innate ideas, and to ascribe all our knowledge of sensible objects to impressions acting upon an innate capacity to receive ideas. Were it possible for a child to grow up to manhood without the use of any of its senses, it would not possess a single idea of a material object; and as all human knowledge is composed of simple ideas, this person would be as destitute of knowledge of every kind, as the grossest portion of vegetable or fossil matter.[26] Again, the account which has been given of animal life furnishes a striking illustration of the origin of human actions by the impressions of motives upon the will. As well might we admit an inherent principle of life in animal matter as a self-determining power in this faculty of the mind. Motives are necessary not only to constitute its freedom, but its essence; for without them there could be no more will than there could be vision without light, or hearing without sound. It is true they are often so obscure as not to be perceived, and they sometimes become insensible from habit, but the same things have been remarked in the operation of stimuli; and yet we do not on this account deny their agency in producing animal life. In thus deciding in favor of the necessity of motives to produce actions, I cannot help bearing a testimony against the gloomy misapplication of this doctrine by some modern writers. When properly understood it is calculated to produce the most comfortable views of the divine government and the most beneficial effects upon morals and human happiness.[27]

Thus far the system of Rush exhibits the three familiar marks of materialism, namely, a phenomenalistic view of substance, a sensationalistic of perception, a deterministic of volition. Now there are added certain incongruous elements. Seeking to apply his doctrine to the sphere of theology the Philadelphian embellishes it with remnants both of an earlier deism and even of that Edwardean occasionalism, which had not been obliterated when Rush was an undergraduate at Princeton. The best criterion of the truth of a philosophical opinion, he continues, is its tendency to produce exalted ideas of the Divine Being and humble views of ourselves. The doctrine of animal life which has been delivered is calculated to produce these effects in an eminent degree. It does homage to the Supreme Being as the governor of the universe, and establishes the certainty of his universal and particular providence. Admit a principle of life in the human body and we open a door for the restoration of the old Epicurean or

[23] Animal Life, pp. 62, 64.
[24] Ibid., p. 11.
[25] Animal Life, pp. 73, 74, 75.
[26] Ibid., p. 78.
[27] Ibid., pp. 79, 80.

atheistical philosophy, which supposed the world to be governed by a principle called nature, and which was believed to be inherent in every kind of matter. The doctrine I have taught cuts the sinews of this error, for by rendering the continuance of animal life, no less than its commencement, the effect of the constant operation of divine power and goodness, it leads us to believe that the whole creation is supported in the same manner.[28]

To this last observation of the last lecture on *Animal Life* Rush at some later period added a disquisition on *Liberty and Necessity*. As extracted from his unpublished *Letters and Thoughts*, and containing an erased passage of no small originality, it will bear generous quotation:

Is it not absurd to talk of *past* or *future* when we speak of the knowledge of the Deity? Can anything be *past* or *future* to a being who exists from eternity to eternity? Are not past, present, and future to *Him*, one eternal *now*? Is not time a finite idea only, and past and future knowable only to finite beings? May not the moral actions of men then have appeared as complete to the Deity at the creation as the *material* world? I see the objects of a plain before me as distinctly as if I were near it. My view of it has no influence on its form or distance; the same probably occurs to the Deity with respect to pre-existing actions. Imperfect man by *memory sees* past events—a wonderful power in a finite mind! May not a perfect being see future events in the same manner? They all have an existence in the eternal mind. *There is nothing* truly *new* in actions, any more than in truths *under the sun*. There can be no contingency with the Deity—all is fixed and immutable with Him; cause and effect, *motive* and *action*, creation and preservation, all one simple object and act. . . . The perfections of the Deity require this solution of this doctrine. *Prescience* is only a human term, but, like many others applied to the Deity in accommodation to our weak capacities. Prophecies are to Him things present; to us things to come—hence their great accuracy. It is improper and dishonorable to His glorious Oneness in existence as well as nature. It is impossible matters should be otherwise. Succession belongs only to man. God can do and know nothing in succession. So far for necessity. But all this is compatable with the most perfect liberty. The knowledge of God of actions flows from a perfect knowledge of the union between cause and effect in creation. All is still free. An artist can tell from the construction of a machine exactly its strokes, etc., without touching it after its wheels are set in motion, although he still upholds it in his hand. We still live, move and have our being in *God*. . . . Nor does this idea destroy man's responsibility. He is still free. His liberty is essential to the necessity—otherwise his action would have no moral nature and could not be the object of pardon, and for this purpose alone evil existed. It must be free to be a crime, and crimes existed, not for a display of vindictive justice in endless punishment, but for the display of love in justice in endless and and universal happiness. This removes all the fears and difficulties about moral necessity. It was necessary that man should fall—it was likewise necessary that he should be *free*, or he could not have fallen. Liberty and necessity are, therefore, both true, and both necessary to advance in due consistency all the glorious attributes of God. This union of liberty and necessity may be illustrated by a simple example: [1. I walk on the deck of a ship. Here is one free motion—the helmsman steers the ship in the direction in which I walk, and yet I am not influenced by his helm, not he by my walking; we both direct our course the same way—he, by pointing the bow of the ship, makes me keep the same course with him, but without my knowledge or his influence over my will. 2. I resolve to take a walk to an adjoining village. This is the first act of my will. On my way I forget the original act of my will and occupy it upon twenty other objects, none of which have any connection with the first. Here then is a will within a will.] I require a perfect knowledge of a man's taste in building, and then convey secretly into his hands a plan of a house. Every act of this man in building this house is foreknown by me, and yet no influence is exercised over his will. Here is necessity and liberty united.[29]

This is a reactionary document, betraying the conflict between the spirit of orthodoxy and the spirit of free inquiry. As a projected addition to the essays on *Animal Life* it explains the opposition to the revival of the ancient "atheism" and also the closing confession that the author feels as if he had waded across a rapid and dangerous stream. The figure is a good one; it exhibits Rush as conscious of the drift of his speculations. And yet in opposing his dualistic occasionalism to a monistic hylozoism, he was but vainly struggling against the tendency of materialism toward a single unitary principle,—the reduction of both mind and matter to modifications of the same common substance.

That tendency as regards anthropology, if not cosmology, is manifested in the opening passage of the next lecture *On the Utility of a Knowledge of the Faculties and Operations of the Mind to a Physician*. Man is said to be a compound of soul and body. However this language may be in religion, it is not so in medicine. He is, in the eye of a physician, a single and indivisible being, for so intimately united are his soul and body, that one cannot be moved without the other.[30] This is the doctrine of the homogeneity of man. In substituting it for his earlier dualism, Rush was undoubtedly influenced by his friend Priestley, who had read the Philadelphian's earlier lectures and called them sublimely speculative.[31] But while this supplementary lecture begins with a decided monistic turn, its force is speedily dissipated by the intrusion of pluralistic arguments,—the dividing up of an indissoluble being into separate faculties. Among these are included not only memory, imagination, and understanding, but in addition, the principle of faith, the passions, the moral faculty, conscience, and a sense of deity.[32] Disregarding Locke's warning against supposing the faculties to stand for some real beings in the soul,[33] Rush has weakened his initial plan by the assumption that there are minds within a mind, extra agents within a single agent. Nevertheless, this complexity has its practical side. Like the modern assumption of selves split off from the self, multiple personalities within one body, it calls attention to the intimate relations subsisting between the psychical and the physical, and leads to a fruitful study of the abnormal and pathological. Or, as Rush himself puts it, a knowledge of the faculties and operations of mind fur-

[28] Animal Life, p. 81.

[29] Ridgeway MS., Letters and Thoughts, pp. 28-30.

[30] Lecture XI, 1805, p. 256.

[31] Cf. Bolton, Scientific Correspondence of Dr. Priestley, letters of Aug. 8, 1799, and Jan. 27, 1802.

[32] Utility, p. 257.

[33] Human Understanding, Bk. 3, chap. 21, § 6.

nishes many useful analogies by which we are enabled to explain or illustrate the actions of the human body. Like the will and its motives, these actions do not occur without the influence of external and internal impressions, association and habit; indeed, as pathology shows, the different faculties of the mind when unduly exercised act specifically upon certain systems and parts of the body.[34] Moreover, this science of mind can be applied to abnormal as well as normal. Since the operations of the understanding act upon the brain and vary with sex, rank, profession, climate, season, time of day, they will explain morbid phenomena of the body and mind, particularly the causes of dreams, trances, phantasms, and supposed voices; all of which have been superstitiously ascribed to supernatural influence.[35] For example, unfavorable changes discovered in diseases in the morning are often the effect occasioned by the disturbing dreams of the night before; while the pain of a surgical operation is often lessened by telling the patient that the worst part of it has been performed.[36] Having touched on suggestive anæsthesia some forty years before the application of material anæsthetics in America, and having mentioned the influence of the passions in curing the diseases of the body, the lecturer now maintains that their efficacy is much greater in curing the diseases of the mind. To compose and regulate the passions, there are to be found means ranging from the physical influence of music to the removal of painful associations of ideas, as when a fever, caught while out gunning, was cured by removing the gun from the ill man's room.[37]

It is at this point that Rush's underlying quantitative conception of mentality again crops out. In his *Animal Life* he had spoken of the tempers and dispositions of the mind as if they were so many psychical quarts and pints. Here the faculties and their operations are presented as if they formed a parallelogram of forces, a framework of calculable energies. Thus, by opposing a new and fresh to an exhausted passion, by combining two passions against one, by giving a passion, that has operated in a retrograde course, its natural direction, madness, from the influence of the passions upon the understanding and will, has often been cured, without the aid of any other remedy.[38] Granted that this way of looking at things may appear strange, it still has its advantages. It renders the science of mind an exact science, not a chimerical and uncertain thing. While it bore the name of metaphysics, and consisted only of words without ideas, of definitions of nonentities, and of controversies about the ubiquity of spirit and space, the materiality and immateriality of mind,—it deserved no quarter from the rational part of mankind. But the science I am now speaking of is as real as any of the sciences that treat upon matter, and more certain and perfect than most of them. Note the changes and improvements that have taken place in the theories of every branch of what is called physical science within the last two thousand years. Very different is the state of phrenology, if I may be allowed to coin a word to designate a science of the mind. Most of the leading opinions and observations of Locke, Condillac, Hartley, and Reid may be found in the writings of Aristotle and Plato, and discoveries in this science are now as rare as they are in anatomy. The reason of this certainty and near approach to perfection is obvious. The mind is the same now as it was in the time of those illustrious Greek philosophers, and of course exhibits the same phenomena in all its operations to the moderns, that it did to them. It is moreover always present with us, and always subject to our observations. It requires no excursions from home, no apparatus of instruments or agents, to develop its operations; hence there is nearly the same coincidence of opinion concerning them that there is of the qualities of bodies that act upon the senses.[39]

This is the concluding passage of the lecture of 1805. It is interesting and eloquent but at the same time disappointing. Rush's analogies sound like original discoveries and promising anticipations; but they are neither. His hints regarding suggestive therapeutics were to be traced back to the Zoönomic philosophy, his suggestions regarding the localisation of cerebral functions became involved in phrenology. The Philadelphian appears to have utilized the word a decade before Hunter applied it to the system of Gall and Spurzheim.[40] Unfortunately his use of this "history of the faculties of the human mind," as he elsewhere defined it,[41] betook of the nature of a pseudo-science. In a lecture of this period on *Dreams*, he said: whatever part of the brain is affected the dream that takes place is of that nature,—different parts of the brain being allotted to the different faculties and operations of the mind. Thus, if the moral part is affected, we dream of committing crimes, at the very thought of which we shudder when awake.[42] So, too, the closing part of the lecture defending a knowledge of the faculties is neither original nor sound. Rush confesses that he is not singular in considering such lectures as a branch of physiology, these faculties having been considered by Dr. Haller in his large work, under the title of *sensus interni*.[43] While the American, then, did service in differentiating his science of mind from speculative metaphysics, yet he did not succeed in carrying it over into the safer field of psycho-physics. His method was vitiated by the obstinate misconception that reflection is the chief avenue to knowledge. Here he might be contrasted with Franklin, follower of no subjective school, but believer in any objective experiment. One can imagine what the latter would have made of Judge Hopkinson's suggestion regarding the composition of a scale of pleasurable sensations by the fingers, analogous to the musical scale, by means of objects of dif-

[34] Utility, p. 258.
[35] Ibid., p. 259.
[36] Ibid., p. 263.
[37] Ibid., 267.
[38] Ibid., pp. 264-5.
[39] Utility, pp. 271-2.
[40] Cf. Baldwin's Dictionary of Philosophy and Psychology, *sub verbo*.
[41] Lecture XII, on Hippocrates, p. 295.
[42] For an adverse opinion of Gall's Craniology, cf. Medical Repository, 11, 428, N. Y. 1808.
[43] Utility, p. 272.

ferent degrees of softness and smoothness."[44] Rush considered his friend's thought an ingenious one, but did not carry it into execution. For this his earlier training was to blame. For instruments of precision he preferred simple introspection. On the verge of possible discoveries realism bandaged his eyes.

Notwithstanding this preference for inward over outward observation, hints for a primitive experimental psychology are given in the ensuing lectures *Upon the Pleasures of the Senses and of the Mind.* Having described the offices of the senses, the author now intends to enumerate their pleasures, and to inquire into their causes, that is, into the changes which are produced in the nerves by the sensation of pleasure.[45] Of these two inquiries the former, as might be expected, leads to a perfect medley of facts and fancies. Among the senses of touch are given the sensation of perfect health which the Germans call self-feeling;[46] the joy of fear which the Indians experience after surviving a bloody victory; the sensation of tickling which partakes of both pain and pleasure. An illustration of the pleasures of sight is Hogarth's line of beauty which delights the eye because it consists of an unbroken curve; an instance of the pleasures of sound that of the winds, rains, and streams of water—all doing homage to the ears of man. More important than this enumeration of the pleasures of the senses, is the inquiry into the accompanying changes produced in the nerves. The fundamental proposition here is that the pleasure we enjoy from music is derived from a certain order and relationship of vibrations, which are excited in the ear, to each other; while the pain we feel from discord is produced by the want of order, or relationship, in the vibrations which strike the ear.[47] Rush had once decried the Hartleian theory of vibrations, here he makes a particularly unhappy application of it. Assuming that the pleasure we derive from our ears is ascribable to impressions and vibrations of a peculiar kind, and pain to an excess or dissonance of similar impressions, he states that it is from this organ that he borrows his analogies to explain the causes of pleasure and pain in all the other organs.[48] For example, the pleasure derived from contemplating a beautiful face is produced by certain harmonious motions in the retina of the eye; the pleasures of the table by a harmony in the relations of the aliments, provided, of course, that there is no mixture with indelicate toasts and bacchanalian songs; the pleasures of smell by a difference in harmony imparted to the nerves of the nose by the scale of odors. Here magnolia may be said to resemble bass, the rose tenor, the wall-flower the treble tones! In fine, all the pleasures of the senses being produced from greater or less degrees of harmony analogous to the vibration of musical sound, our bodies may be compared to a violin; the senses are its strings; everything beautiful and sublime in nature and art is its bow; the Creator is the hand that moves it; and pleasure, nearly constant pleasure, their necessary effect![49]

To these ridiculous analogies the other materialists made more or less direct answer. Buchanan, of Kentucky, protested against turning the human system into a violin; Cooper, of South Carolina, ironically mixed a sort of vibratory punch in which the spirits and the lemon were blended in harmonious proportions. But aside from Rush's figures of speech, attributable to the pedagogue's propensity to make matters clear to the meanest intelligence, the lecture on the *Pleasures of the Senses* contained a number of valuable observations, summed up in the form of laws of sensation. Such were the statements that some pleasures are increased, others lessened by repetition; that motion in the organ increases the sensitivity of touch; that the loss of the use of one sense often increases the pleasures of another, the blind enjoying music more than those who possess their eyesight; finally, that we are able to receive only a single sensation in our minds at once, the impressions of yellow and blue, for example, exciting the green color.[50] These laws, for one thing, lead Rush to disagree with the theory of Edmund Burke, presented in his treatise on the *Sublime and Beautiful,* that relaxation is so extensive a source of pleasurable sensations. Rather should one conclude that motions of a moderate degree of force, and in regular order, constitute pleasure; and that motions in excess, and out of order, constitute pain.[51] Or, to use an obvious simile, pleasure may be compared to a clear stream of water flowing with rapidity through a straight and narrow channel; pain to the same stream rendered turbid by flowing with accumulated velocity and in every possible direction.[52]

Rush's laws of sensation appear the more safe as they are the less specific. When freed from such latent metaphors as the senses being so untuned by diseases as to emit no tones of pleasure, they stand as suggestive contributions to current knowledge. Such are the closing remarks that the pleasures of the senses are of short duration; that they are of limited nature as to their degree—no ingenuity being ever able to raise them so high as to perfectly satisfy the mind; finally, that they are so nearly related to pain that they often terminate in it. In the last of these summary negations the materialist has well nigh formulated a law of diminishing return applicable to the psychical field. But herein his first aim is apparently not so much to uphold exact science as practical piety. He means to show that numerous and delightful as are the pleasures of the senses, they have their alloy, and yet that, in these evils, heaven is still kind,—since we are taught by them to aspire to more sublime and durable pleasures of the mind, the subject of the next lecture.[53]

In this supplementary treatise the author pursues the same order as before. He enumerates the pleasures of each of the

[44] Pleasures of the Senses, p. 409.
[45] Pleasures of the Senses, p. 399.
[46] Cf. Rush's essay on the "Manners of the German Inhabitants of Pennsylvania."
[47] Pleasures of the Senses, p. 428.
[48] Ibid., p. 432.
[49] Pleasures of the Senses, pp. 424-5.
[50] Ibid., pp. 425-6.
[51] Ibid., p. 432.
[52] Ibid., p. 428.
[53] Ibid., p. 436.

faculties; inquires into their proximate cause; and concludes with some general remarks. As another introductory lecture the subject must be made interesting at all hazards. So, under the first of these topics there appears the customary mixture of rhetoric and anecdote. By the memory we command, as it were, the suns that have gone down to rise again; by the understanding we gain the most delicate and sublime pleasures. The nature of this may be conceived from the fact that Mr. Rittenhouse fainted upon perceiving the transit of Venus on the third of July, 1760. Again, the pleasures of the association of ideas are so peculiar a nature that an old African slave, who saw a lion conducted as a show through New Jersey, was transported with joy, being carried back to the days of his boyhood in his native country.

Having pointed his moral with provincial tales, and brought the subject down to his hearers, Rush returns to his original quest,—the higher hedonism of intellectual pursuits. Here he emphasizes the pleasures of the will as consisting in contemplating the mysterious union of free agency and necessity in all its operations. We are barely pleased with what we understand; but the exercise of admiration is necessary to our intellectual happiness, and this can be employed only upon subjects which are removed beyond our comprehension. While we thus contemplate, with a delightful wonder, the union of free agency and necessity, we derive pleasure from a sense of each of their respective operations. The pleasure we enjoy in free agency is felt in the sacrifices that we make for the attainment of liberty and in reflecting that we are masters of ourselves. The pleasure we enjoy in a belief in the will acting from necessity is in disposing us to view the hearts of all the men that move our world by their powers or their talents, as under the direction of a wise and good being; and it assures us that all the events that relate to our individual happiness, whether from moral or physical causes, are in his hands and that his hand is in every event. I am aware that I dissent from two popular and rigid sects of philosophers and divines, in thus admitting the truth of the opinions held by each of them. But an exclusive belief in either of them, so far from being attended with pleasure, is calculated to excite misery and despair. I repeat, therefore, what I said formerly in speaking of the operations of the will, that both opinions appear to me to be alike true; and that we act most freely when we act most necessarily, and most necessarily when we act most freely.[54]

Here are the paralogisms of the pure reason considered not as mutually exclusive but as actually complementary. And nothing could better exemplify Rush's habit of looking on both sides of the shield at once. The only ground and justification for reaching such a cross-eyed conclusion lay in his private paper on *Liberty and Necessity*. But this, as previous inspection showed, left the matter decidedly undecided, the best argument being a suppressed simile. Equally unsatisfactory is the author's treatment of the problem of personality, incidentally subsumed under the pleasures of consciousness. Identity, it is asserted, may be conceived of from a single fact. There never was a man who was willing to change his own mind for that of any other person, however willing he might be to exchange his condition, limbs, and face with him.[55] In thus generalizing from a single instance Rush seems to ignore the perversions of consciousness. It was apparently not until later that he met with the anomaly of double personality in the reputed two minds of the somnambulist. This one-sidedness is exceptional, for in treating of his favorite faculty, the moral sense, Rush takes a broader outlook and includes both the extreme and abnormal manifestations of this activity. He holds that the intensity of the pleasures derived from this source is so great, that it may destroy bodily pain,—as in the case of the primitive martyrs to Christianity, who had joys even in the flames of fire. And the perversions of the same faculty are so remarkable that it may become a veritable idiosyncrasy,—as in the case of the Parisian in the reign of Robespierre, who declared that the most delightful music he ever heard was the sound of the guillotine.[56]

Having enumerated the pleasures of the mind and some of their perversions, the author comes to his second inquiry—their proximate cause. This may be summed up in a few words. They are the effects of impressions of a certain definite or moderate degree of force, accompanied with motions of a regular or harmonious nature in the brain and heart and communicated by them to the mind. This is to be inferred from dissections, which discover marks of undue or irregular excitement in the brain and of rupture or disorganization in the heart, where death has been the consequence of an excess of intellectual or moral pleasure.[57] In his extreme zeal for palpable results the materialist has assumed a cause too great for its effects. His contention, however, may serve as a fitting transition to his last and most extended work of philosophic interest, the *Medical Inquiries and Observations upon the Diseases of the Mind*. Published in 1812, at the solicitation of the author's pupils, this volume is said to be a supplement to materials already collected, a set of new principles founded upon old facts.[58] Unfortunately for his claims to originality Rush neglects to refer to the books from which he drew these facts. Then, too, he repeats many of his former borrowings. Again are the faculties lengthily enumerated, and a special plea made for the sense of deity according to Lord Kames; again are they defined, in the manner of Haller, as internal senses, depending wholly upon bodily impressions to produce them. Indeed, it said after the fashion of Locke, as well might we attempt to excite thought in a piece of marble by striking it with the hand, as expect to produce a single operation of the mind in a person deprived of the external senses.[59] With these resemblances to former doctrines there yet goes a difference; there is a similar combination of realism and sensationalism, but

[54] Pleasures of the Mind, pp. 441-3.

[55] Pleasures of the Mind, p. 449.

[56] Ibid., p. 445.

[57] Ibid., p. 452.

[58] Observations, Preface, p. v.

[59] Ibid., p. 11.

the materialism is slightly modified. The Hartleian figures of speech are dropped and a safer generalization adopted. No longer is the body compared to a musical instrument, or the senses spoken of as untuned by diseases so as to emit no tones of pleasure. Refusing then, like Priestley and like his own colleague Frederick Beasley, of the University of Pennsylvania, to commit himself to any specific theory of vibrations, Rush carries out his previous implications in the following postulate: all the operations in the mind are the effects of motions previously excited in the brain, and every idea and thought appears to depend upon a motion peculiar to itself. In a sound state of the mind these motions are regular, and succeed impressions upon the brain with the same certainty and uniformity that perceptions succeed impressions upon the sense in their sound state.[60] Except for an unwarranted assumption of the priority of the physical over the psychical, Rush's thesis might almost be counted a rough formulation of the theory of psycho-physical paralellism. At the least it is a practical working hypothesis, or, as he puts it, a system of principles that shall lead to general success in the treatment of the diseases of the mind.[61]

Having considered the faculties and operations of the mind, it is in order to inquire into the proximate cause of intellectual derangement. Here the American alienist reviews the erroneous opinions on this subject from the ancient notion that the liver is the seat of the trouble, to the modern belief in favor of madness being an ideal disease. The former theory Rush had met in his lecture on the *Opinions and Modes of Practice of Hippocrates;* the latter, as to madness being purely psychical, he objects to for three reasons: first, because the mind is incapable of any operations independently of impressions communicated to it through the medium of the body; second, because there are but two instances upon record of the brain being found free from morbid appearances in persons who have died of madness; third, because there are no instances of primary affections of the mind, such as grief, love, anger, or despair, producing madness until they had induced some obvious changes in the body.[62]

In this same thorough manner the doctor next examines the remote and exciting causes of intellectual derangement. Briefly put, these are of two classes: first, those that act directly upon the body, as malconformations and lesions of the brain; second, those that act indirectly upon the body through the medium of the mind, as intense study over the means of discovering perpetual motion, or even researches into the meaning of certain biblical prophecies.[63] In the ten score pages following this preliminary section, Rush presents what he calls a new nomenclature of mental diseases, from tristimania to manalgia,—a cobweb of technicalities as involved as the Zoönomic classification. Occasionally the author presents clear and illuminating psychological observations, as in his definition of demence as consisting, not of false perceptions, but of an association of unrelated perceptions, wherein the mind may be considered as floating in a balloon, and at the mercy of every object and thought that acts upon it.[64] But in general, Rush in this part of his work has been pronounced often discursive and sometimes inconsequential, with a tendency to expand and multiply rather than to condense and critically classify.[65] The last reference is especially applicable to the earlier articles on the *Different Species of Phobia and Mania.* Among the former are instanced the cat-phobia and the solo-phobia, the phobia being excellently defined as a fear of an imaginary evil, or an undue fear of a real one. Among the latter are described the land-mania which is especially prevalent in the United States; and liberty-mania which shows itself in visionary ideas of liberty and government,—when men expect liberty without law, government without power, sovereignty without a head, and wars without expense.[66]

In these statements the American exhibits all the fanciful ingenuity of the modern French alienists with their movable arrangements of fixed ideas. But he has more solid parts and in his chapter on the derangement of the will is declared to have led his generation and forecasted the later work of Ribot.[67] This estimate seems exaggerated. Rush enumerates but two ways in which the will is affected by diseases, one of which is treated too superficially, and the other too metaphysically. There is first a negative affection, aboulia, or what he would call a debility and torpor, or loss of all sensibility to the stimulus of motives. In this he says he has never been consulted, yet he has been informed by his friend Brissot that animal magnetism will cure light cases. He suggests, however, that persons afflicted with this disorder of the mind should be placed in situations, in which they will be compelled to use their wills, in order to escape some great and pressing evil. A palsy of the limbs has been cured by the cry of fire and a dread of being burned. Why should not a palsy of the will be cured in a similar manner?[68] But to proceed: there is, second, a privative affection of the will, when it acts without a motive, by a kind of involuntary power. Rush is here at pains to set forth the two opinions that have divided philosophers upon the subject of the operations of the will and to grant that freedom is as true as necessity. But in spite of his effort to reach a perfect metaphysical impartiality he finds himself on the necessitarian side of the fence. That derangement of the will in which it acts without a motive, by a kind of involuntary power, is exactly the same thing that occurs when the arm or foot is moved convulsively without an act of the will, or even in spite of it.[69]

Such notions of the diseases of the will as affecting the

[60] Observations, p. 11.
[61] Ibid., Preface, p. vi.
[62] Ibid., p. 16.
[63] Ibid., pp. 30-37.
[64] Observations, p. 257.
[65] C. K. Mills, Benjamin Rush and American Psychiatry, Medico-Legal Journal, Dec., 1886, p. 34.
[66] Columbian Magazine, 1786-7, pp. 110-113, 177-180, 182-187, 305.
[67] Mills, op. cit., p. 10.
[68] Diseases of the Mind, pp. 268-270.
[69] Ibid., p. 263.

moral faculty had at the least a practical value in Rush's ideas of medical jurisprudence; his corresponding notions of the disease affecting the believing faculty has not even a theoretical worth. Assuming a realistic principle of faith he uses it, first, as a peg upon which to hang more anecdotes, then, as a club to throw at the idealists. Defining his favorite faculty as that principle in the mind by which we believe in the evidence of the senses, of reason, and of human testimony, he gives as an instance of its excess an old Revolutionary quidnunc who, like Horace's character of Apella, believed everything he heard; and as an instance of its deficiency Burke's description of those who "believe nothing that they do not see, or hear, or measure with a twelve-inch rule." This incredulity, adds Rush, is not confined to human testimony. It extends to the evidence of reason and of the senses. The followers of Berkeley either felt or affected the last grade of this disorder in the principle of faith. That it is often affected, I infer from persons who deny their belief in the utility of medicine, as practiced by regular-bred physicians, but believe implicitly in quacks."[70] Since it affects both his preaching as a realist and his practice as a materialist, the Scotch-trained doctor now offers a sort of logical prescription for this insanity of doubt. The cure for a weak mental digestion is to go back to a plain intellectual diet,—or as he puts it: the remedy for this palsy of the believing faculty, should consist in proposing propositions of the most simple nature to the mind, and after gaining assent to them, to rise to propositions of a more difficult nature."[71]

In the succeeding chapter on derangement in the memory there is presented a dry catalogue of the various forms of this disease. Lacking a technical nomenclature, it nevertheless contains implicit recognition of the various forms of amnesia. Among those given is an oblivion of names and vocables, of the sound of words but not of the letters which compose them, of the qualities or numbers of the most familiar objects, of events, time, and place. Instances of these lapses in the memory are forthwith presented,—from Rush's own friends to his patients in the Philadelphia hospital,—from the absent-minded Dr. Magaw of the university, to an Italian victim of the yellow fever, who in the beginning of his malady spoke only English, in the middle only French, and on the day of his death only the language of his native country."[72] Rush here obtained an insight into retrogressive amnesia, yet in treating of the results of the weakness and loss of memory he is even more superficial than before. He resorts to the once-rejected scholastic realism, speaking of the objects of knowledge as either sleeping or perishing in the mind. Finally, he gives a most inadequate account of the causes of these things. Among mental causes he mentions the oppressing the memory in early life with words and studies disproportioned to its strength, as prematurely crowding Latin and Greek into boys' minds; and also the undue exercise of memory upon any one subject, as in the case of the negro calculator, Thomas Fuller, of Virginia, who was famous in numbers, but could not recollect faces."[73]

The chapter on dreams and somnambulism is an equally hasty performance, yet may be happily supplemented from other sources. Dreaming is here said to be always induced by irregular or morbid action in the blood-vessels of the brain, hence it is accompanied with the same erroneous train, or the same incoherence of thought which takes place in delirium. This is so much the case that a dream may be considered as a transient paroxysm of delirium, and delirium as a permanent dream."[74] Again, somnambulism is nothing but a higher grade of the same disease. It is a transient paroxysm of madness. Like madness it is accompanied with muscular action, with incoherent or coherent conduct, and with that complete oblivion of both which takes place in the worst grade of madness. Coherence of conduct discovers itself in persons, who are afflicted with it, undertaking or resuming certain habitual exercises or employments. Thus, we read of the scholar resuming his studies, the poet his pen, and the artisan his labors, while under its influence, with their usual industry, taste, and correctness."[75] As a foil to these dogmatic definitions and unqualified assertions, Rush on other occasions made a number of additions and conjectures. Suggesting that dreams are useful to prognosticate incipient diseases and to prevent delirium from too great excitability, he goes on to say that we never dream of things the raw material of which did not exist in the mind previously. So dormant or lost ideas are often revived in dreams and recollected afterwards. The fact that I remembered the name of a forgotten classmate of the Jersey college after a dream proves, not that such a recollection was a preternatural occurrence, but simply that nothing exists in the brain but that which had previously entered through the medium of the senses."[76]

As Rush's sensationalism rescued him from a magical conception of the phenomena of dreaming, so did his materialism from a similar view of the phenomena of somnambulism. Here is given, in a remarkable anticipation of later French discoveries, a case of continuous memory in trances, of patching up recollections into an unbroken secondary series. Somnambulists, he reasons, recollect in each fit what they did in the preceding one, as in the case reported by Dr. Lentwork, [?] of Springfield, to the Reverend Dr. Stiles, of Yale. They appear to have two distinct minds, but may this not be owing to impressions made on the other parts of the brain by diseases and re-excited by the same stimulus?"[77] It must be granted that Rush has here ingeniously approached the problem of dual personality, previously ignored, by a sort of anticipated nerve-tract theory.

[70] Diseases of the Mind, pp. 276-7.
[71] Ibid., p. 274.
[72] Ibid., p. 276. Cf. W. B. Carpenter, Principles of Mental Physiology, London, 1879, p. 437.
[73] Diseases of the Mind, pp. 281-2.
[74] Ibid., pp. 300-1.
[75] Ibid., p. 304.
[76] Purnell MS., p. 128.
[77] Ibid., p. 133.

In his next topic he is not so modern. He defines an illusion as a sort of waking dream, a disease in which false perceptions take place in the eyes and ears from a morbid affection of the brain. The deception consists most commonly in hearing our own names, for the reason that we are accustomed to hear them pronounced more frequently than any other words. Hence, that part of the ear which vibrates with the sound of our names moves more promptly, from habit, than any other part of it.[78] This naturalistic explanation is put forward against the beliefs of superstitious people, who say that these false perceptions are premonitions of death. Yet the author is careful to add that it may not be applied to invalidate the accounts of the supernatural voices and objects that were seen or heard by individuals in the Old and New Testaments.[79]

Allowing no conflict between his science and his religion, Rush offers in his final chapter on the *Diseases of the Mind* a plea for what he calls a system of Christian jurisprudence. Though based on a cramped and narrow psychology, it was given a broad and fruitful application. The disease of the will, it is assumed, discovers itself only in the moral faculty and exists with a sound state of the conscience and sense of the deity. Hence, as the lecturer had previously declared, it would be as absurd to inflict the punishment of death upon a fellow creature for taking away a life under a deranged state of the will, as for a surgeon to cut off an arm or a leg because in its convulsive motions it injured a toilet or overset a tea table.[80] Now, while these morbid operations of the will may include in their consequences even theft and murder, yet they are to be considered, not as vices, but as symptoms of a disease. Therefore, for persons thus afflicted legislators should abolish the punishment of death, cropping, branding, and public whipping, and substitute for them confinement, labor, simple diet, cleanliness, and affectionate treatment. As is shown by the moral effects thus produced in the jail of Philadelphia, the reformation of criminals and the prevention of crimes can be better effected by living than by dead examples![81]

This semi-political peroration concludes the last of Rush's philosophizings. Contrasted with the first, the undergraduate transcription of scholasticism, it illustrates his saying that it was time to take science out of the hands of philosophers and put it into the hands of the people.[82] Here is a principle much in the spirit of Franklin. Applied as a criterion to Rush's own works, it shows him to be a popularizer rather than a speculator, an advocate of concrete results rather than of abstract consistency. So, however much Rush accomplished as a practical reformer, the natural and inevitable outcome of such a principle was to make his metaphysics a thing of inconsistencies. As a transitional thinker he strives to be so impartial that he takes both sides at once. His "cold common sense" is offset by a phenomenalism in which "ideas are mere qualities, having no more reality than the sound of a hammer or a bell."[83] So, too, the principle of animal life, excitability, is allowed in one place to be either a quality or a substance;[84] in another it is looked upon as a sort of vital phlogiston, which was to be drawn off from animal matter as freely as Rush himself drew blood from his patients.[85] Again, while diseases of the mind are counted as veritable derangements of a constituted order, real evils in this present world, still it is likewise held that "all evil has wisdom in it, and every folly and vice, like every particle of matter, is necessary."[86]

In fine, if these scattered inconsistencies be fitted into the divisions of epistemology, ontology, and cosmology, Rush's system is found to issue in a mutual cancellation of terms. That this was due to the varying influences of conflicting schools of thought—realism, materialism, and an obsolescent deism—becomes evident in a criticism of his main field of endeavor. Rush's psychology was vitiated by a kind of realistic phrenology, in which imaginary faculties are immured in so many water-tight compartments. Now such a confinement within arbitrary limits had a two-fold defect: it prevented the attainment of a correct view of precise cerebral localization, and of the general activity of the brain in the higher thought processes. Rush is again but half right in his genetic methods. He recognizes the growth of the child mind, and attempts to map out the steps in its mental development; but he fails to see that the decline of the intellectual powers occurs in an order the reverse of that of their acquirement. The doctrine of retrogression, which he touched upon in his mature essay on *Old Age* is twisted by an earlier deistic bias. Giving the order in which the mind declines as first the memory, then the imagination and understanding, he adds, that the sense of the Deity is never forgotten.[87] A lost memory which never forgets something is a cause for astonishment, and yet despite this and his other defects Rush was no more inconsistent than those upon whom he drew. Like the Zoönomic philosopher he put in the same basket fragile innate faculties and lively vital movements. Like Hartley he added teleological trimmings to a doctrine of philosophical necessity: nothing was made in vain; every power, principle, and feeling of the body and mind must answer to the end of their creation.[88] For these things, Rush, as a transitional writer, was hardly to blame. Struggling in the stream of conflicting currents, he was indeed in a poor position to estimate their relative forces. In other words, the times were against him. Historically, he was not so placed as to obtain the right perspective. No more

[78] Diseases of the Mind, p. 307.
[79] Ibid., p. 308.
[80] Medical Jurisprudence, p. 388.
[81] Diseases of the Mind, pp. 365-6.
[82] A. E. B. Woodward, "A System of Universal Science," p. 239, Philadelphia, 1816.
[83] Purnell MS., p. 90.
[84] Animal Life, p. 6.
[85] Cf. Utility of a Knowledge, etc., p. 258.
[86] Purnell MS., p. 90.
[87] Purnell MS., p. 96.
[88] Thoughts, MS., p. 47.

than his masters could be aware of the fact that his realism was a drawing away from his materialism, just as his materialism was from his deism.

Rush's system was a syncretism, a mode in which varied movements were fused. It was, therefore, capable of a variety of interpretations. These it received at the hands of both contemporaries and followers. An anonymous London deist wrote that when it was said that medical men were enemies to the religious view, Dr. Rush was an example to the contrary.[80] So, too, a Philadelphia admirer attributed to Rush the statement that it remains yet to be discovered, whether all the moral, as well as natural attributes of the Deity may not be discovered in the form and economy of the material world.[81] And the same author, in his *Eulogium*, recalling Rush's methods of teaching, said that he urged his students to the study of the anatomy of the human mind, commonly called metaphysics, since the reciprocal influence of the body and mind upon each other can only be ascertained by an accurate knowledge of the faculties of the mind and their various modes of combination and action. To this end they should study Butler, Locke, Reid, Beattie, and Hartley.[82]

Interpreted, then, both as a realist and a deist, Rush was yet in the main a materialist. His followers and imitators at home and abroad show this. His own pupils outdid him in the application of the physical principle. One wrote on the effects of the passions on the body;[83] another on the morbid effects of grief and fear;[84] a third made voluntary motion the effect of irritability;[85] a fourth defined volition as a sensorial power secreted in the substance of the voluntary muscles.[86] These opinions were expressed in the inaugural theses of the doctor's students at Philadelphia. A similar use of his name and opinions is to be found in the theses of the early American students in Edinburg.[87] The contents of these treatises may be as dull as their latinity is indifferent, nevertheless, they are of interest in that while some of them refer to Hartley and Darwin, Franklin and Priestley, all of them refer to Rush and thus go to prove that as head of the Philadelphia school of materialists he was of no small influence. That influence, it should be noted in conclusion, was chiefly exerted in the Southern States. From them came the great majority of Rush's pupils, and if to them be added open-minded thinkers, who, like Jefferson, Cooper, and Buchanan, knew either Rush or his works, the South may be looked upon as the most promising field for the spread of materialism. But why that movement failed to flourish there, and how it was rooted out, is another story, connected with the interplay of conflicting forces. But before taking up the important topic of the decline of the English and French materialistic influences, through the rise of natural realism, or the philosophy of common sense, consideration must be given, for the sake of thoroughness, to the case of the minor materialists.

[80] An Interpretation of the Sacred Scriptures, p. 11, London. 1797.

[81] David Ramsay, Eulogium . . . of David Rittenhouse, p. 27, Philadelphia, 1796.

[82] Eulogium, p. 124.

[83] Henry Rose (Va.), 1794.

[84] William Hall (S. C.), 1812.

[85] John Hart (N. C.), 1806.

[86] Robert Mayo (Va.), 1808.

[87] Such as C. Berkeley (Va.), 1793, De Corpore Humano; R. B. Screben (S. C.), 1799, De Vitae Humanae Gradibus, in the William Osler Collection, in the Medical and Chirurgical Faculty Library, Baltimore.

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A CASE OF MULTIPLE TUMORS IN A DOG.

By ERNEST K. CULLEN. M. B., Baltimore.

(From the Pathological Laboratory of the Johns Hopkins University and Hospital.)

Numerous cases of multiple tumors occurring in animals have been reported and the writer merely adds this case to the already long list without any reference to the literature on the subject, because of its interesting feature: the occurrence of two distinct types of carcinoma—squamous cell carcinoma of the skin and adeno-carcinoma of the prostate.

Clinical history.—The dog was a St. Bernard 12 years of age, weighing 180 pounds.

Family history.—The owner states that the dog came of healthy stock and he knows of no history of malignant disease.

Personal history.—The dog always appeared quite healthy until the onset of the present illness.

Present illness.—In the summer of 1900 a small lump was discovered on the dog's back close to the middle line in the dorsal region. This very gradually became larger and at the end of about three years had attained the size of an orange. In February, 1903, the greater portion of the tumor was removed and the base cauterized. Healing was tardy. During the eighteen months following the operation there were no signs of recurrence.

In November, 1904, recurrence was noted at the site of the operation. Growth was rapid and by April, 1905, the tumor had assumed the proportions of a medium-sized cocoanut. A second operation was resorted to and the tumor, together with a portion of the surrounding skin, was removed. The wound healed *per primam* and no evidences of recurrence have since been observed.

Following this operation, however, the dog never regained its former health. It showed signs of a gradually progressive weakness, and during the last few weeks of its life, any attempt to rise from the floor was marked by symptoms of pain. No gastro-intestinal or genito-urinary symptoms were detected. In October, 1905, the dog died rather suddenly.

The autopsy was performed twenty hours after death.

Pathological Report.—The body is that of a large St. Bernard dog. Over both elbows are decubitus ulcers. In the dorsal region of the back, just to the right of the median line, is a linear scar 10 cm. in length. There is no sign of recurrence of the growth in this situation. The axillary and inguinal glands are not enlarged.

On opening the abdomen the spleen is found to be very much enlarged, measuring approximately 30 x 10 x 4 cm. The capsule is tense but the consistence is soft and flabby. On section a considerable quantity of blood exudes from the surface. The picture is one of recent hemorrhage into the splenic pulp. This is rendered still more evident by microscopical examination.

The lungs are œdematous but show no areas of consolidation. The heart, liver, and kidneys, both macroscopically and microscopically, present the usual picture of cloudy swelling. The stomach and intestines appear normal. The bladder shows some injection about the trigone but otherwise appears normal.

Prostate.—The prostate measures about 4.5 cm. in diameter. It is firm in consistence and externally appears uniform. On section, however, definite pathological changes are visible. Surrounding the prostate is a well-defined white capsule measuring 1 to 2 mm. in thickness. Running from this into the substance of the gland are definite bands of stroma (Fig. A) quite similar in appearance. Between these the tissue has a distinctly honey-combed appearance, is greyish-white in color and rather spongy in consistence (Fig. B). In one portion (Fig. C) the tissue is uniform in appearance, with the exception of a few scattered areas, honey-combed in appearance.

Squamous cell carcinoma of the skin.—It is impossible to obtain a gross description of the tumor.

Histological examination.—Scattered in a stroma of loose connective-tissue are numerous irregularly-shaped alveoli. Lining the periphery of these is a row of low cylindrical epithelial cells more or less regular in outline. Internal to this are numerous layers of epithelial cells with oval or spherical nuclei. The cell outlines are indistinct but the predominating cell appears to belong to the basal type. The nuclei vary considerably in size, one nucleus occasionally being three or four times larger than that of the adjacent cell. The majority of the nuclei are deeply stained. Definite epithelial pearls are present in many of the alveoli and keratinization in parts is extensive. The stroma immediately surrounding the alveoli is rich in connective-tissue cells, but the greater portion consists of loose tissue containing a moderate number of small mononuclear cells. Adipose tissue is present in some places.

Adeno-carcinoma of the prostate.—Sections through the central portion of the prostate show the presence of numerous glands with narrow lumina. Many of these have infiltrated the muscle and the picture is distinctly invasive in character. In most instances the glands are lined by a single layer of well-defined cylindrical epithelium. The individual cells are rather uniform in size and shape. The nuclei which are generally situated at the base of the cell are oval or round,

Adeno-Carcinoma of the Prostate (4 Diameters).

The figure represents a cross section of two-thirds of the prostate. Definite bands of connective tissue A are seen passing from the capsule into the substance of the gland. Between these are areas B, which present a distinctly honeycombed appearance. Microscopically these areas show masses of glands undergoing extensive retrogressive changes. At C the tissue looks uniform, but in a few places are seen small areas similar to B.

fairly uniform in size and deeply stained. Nuclear figures have not been observed. A distinctive feature is the occurrence of extensive desquamation and disintegration. Many of the gland lumina are filled with desquamated cells in varying stages of disintegration. In some instances an amorphous débris fills the gland cavity. Only an occasional normal prostatic gland is found and this at the margin of the section, corresponding to the peripheral portion of the prostate. The connective-tissue stroma is rather dense and contains large numbers of diffusely scattered small mononuclear cells.

Remarks.—The uniformity in size of the epithelial cells leads to some difficulty in the diagnosis, but the essentially invasive character of the growth together with the extensive retrogressive changes classes it as malignant.

Examination of the viscera and the various lymphatic glands showed no evidence of tumor metastases.

NOTE.

At the regular meeting of the Second Section of the American Urological Association, held in New York on Wednesday, October 24, 1906. . . . .

The president, Winfield Ayres, M. D., officially announced the death of the vice-president of the Second Section, William K. Otis, and called for a report by the committee appointed for the purpose, to present a memorial on the Association's bereavement. In presenting the report, a member of the committee said:

"The ties of life-long intimacy which bound most of us to Dr. Otis, makes his death a subject of grief to each individual. The usual set form of preamble and resolutions, therefore, were deemed inadequate by your committee to express our sorrow. 'Billy's' demise is, to the older members of the Association as if a much loved brother had gone from us. Your committee begs to submit:

William Kelly Otis' earthly career ended on September 22nd, 1906.

To the members of the American Urological Association, his death is a threefold blow.

Most of us knew him intimately from his childhood; by his decease we lose a consistent friend, a charming companion, a most estimable colleague.

To the Science of Urology his death means an irreparable loss. Cut off in the midst of his career, his inventive genius is stopped; the new and useful instruments he was continually devising must now be perfected by other hands. The advances in our work, he can no longer aid in developing.

The American Urological Association loses one of its founders, one of its most active coadjutors, one of its truest adherents.

Our Association shares with the family of William K. Otis, with the profession at large, and with that world in which true manhood is understood and appreciated, that deep grief which the death of so noble a character inspires."

RAMÓN GUITERAS,
A. ERNEST GALLANT,
FERD. C. VALENTINE,
} *Committee.*

NOTES ON NEW BOOKS.

The Practice of Pediatrics in Original Contributions by American and English Authors. Edited by W. L. CARR, A. M., M. D., etc. (*Philadelphia and New York: Lea Brothers & Co., 1906.*)

The Practice of Pediatrics (Carr) is a very well arranged and written work, of 1014 pages. The articles are contributed by 14 pediatric authorities, most of them American, and the whole has been edited by Dr. Walter L. Carr. This work is, on the whole, a very acceptable addition to the present collection of text-books on the subject of pediatrics and is up to date in every department, being strong on treatment, and not having its text overburdened with the discussion of fine pathological points. In regard to the different sections of the work there is little preference to be expressed, each subject being handled in a thoroughly practical manner.

The articles on infant feeding, milk modification and kindred matters, are well worth reading by any one interested in the subject, being not only scientifically correct, but abounding in very practical suggestions on small points that are usually not mentioned, the observance of which, however, might often turn the scale from failure to success in nurture of the baby. Very little knowledge on the part of the reader is taken for granted by the writer, and hence the fulness of his article. The work in general is the conventional text-book, well written by able men, well arranged and indexed. There are not as many illustrations perhaps as some similar works contain, but what there are are satisfactory, exhibiting clearly what they are intended to represent. The colored plates showing the various varieties of stomatis, Koplik's spots and smallpox, are particularly good.

The work is a valuable statement of advanced present day opinions in pediatrics, and will be found helpful to both practitioner and student. H. M. F.

Pulmonary Tuberculosis. Its Modern and Specialized Treatment. ALBERT PHILLIP FRANCINE, A. M., M. D. (*Philadelphia and London: J. B. Lippincott Company, 1906.*)

One must admire the clear, practical, sensible spirit in which Doctor Francine's book is written. Although coming from an enthusiast it is free from undue pretention and exaggeration. The matter is justly considered and plainly put so that it will prove a valuable and safe guide to the large class of physicians anxious to help their tuberculous patients, but deprived of the opportunities of practical and special training. It is agreeably written, the pleasure in reading it being only marred in places by gross typographical errors. There are ten plates in the book, and it seems a pity that where so many instructive illustrations might have been produced, one-fifth of the space should be wasted in showing how to give an injection in the back, and how to apply dry cups. The introductory chapter presents unusually well in such a brief form the modern views on the origin and modes of spread of the disease. The consideration of rest, fresh air, diet, and exercise bears the stamp of a large practical experience with the subject. There are no vague generalizations, the directions being definite and specific. Climate is very conservatively and justly treated. While admitting its value under certain conditions, he emphasizes that it is by no means an essential factor in the treatment of tuberculosis. The home is the place where the largest part of the treatment must be carried out in the greatest number of patients, and in its indiscriminate recommendation, climate has probably totalled more harm than good in the arrest and cure of tuberculosis. To us the chapters on the use of the tuberculins and the specific sera are the least interesting in the book because we miss here the flavor of the author's practical experience and personal judgment. They are, however, good reviews. The use of drugs and the management of complications is very well handled. Although one may not have the confidence the author expresses in certain lines of treatment, his therapeutics are reasonable, and they certainly have the advantages that come from a large experience. Throughout this portion of the book, as well as elsewhere, the importance of secondary infections for an adequate understanding of the cause of the disease and its treatment is emphasized. Their varied manifestations, particularly their rôle in the production of hæmorrhage, are interestingly considered. In the last chapter is told briefly how the whole question of tuberculosis is managed under Doctor Flick's direction at the Phipps Institute. One must admire the remarkable opportunities afforded for study. We gladly agree with the author that opinions coming from the Phipps Institute are worthy of great consideration. L. H.

The Harvey Lectures. Delivered under the Auspices of the Harvey Society of New York, by PROFESSORS HANS MYER, CARL VAN NOORDEN and others. (*Philadelphia and London: J. B. Lippincott Co., 1906.*)

As stated in the preface of this volume, the object of the society "is the diffusion of the medical sciences by means of public lectures. . . . . The lectures are not intended to be merely accounts of experimental work done by the lecturers, except in rare instances. They are rather to be a broad presentation, from the

laboratory point of view, of subjects of general interest. . . . . The lecturers are selected on account of a special adaptation through their own research work in the subjects presented by them." No reader will fail to recognize that in the first volume of these lectures the society has admirably attained its object. Addresses on "Tuberculosis" by Prof. Theobald Smith, on the "Heart-beat" by Prof. Howell, on the "Nerves" by Prof. Barker, on "Trypanosomes" by Prof. Ney, not to mention other papers of equal interest and importance, by men recognized by the world as leaders in their special lines of work, give this volume a distinct mark of individuality and notoriety. To the large lay public, which is taking such an active and intelligent share in the discussion of various medical questions, this volume offers the best and latest information on many topics of general interest; but all medical students also will find the lectures well worth reading and study. If the next volumes of this society's papers are of equal excellence, this society will be more than excused for its birth, in these times when too many societies are created without sufficient reason for their formation. R. N.

International Clinics, Vol. IV, 16th series. (*Philadelphia and London: J. B. Lippincott Co., 1906.*)

This quarterly publication invariably contains a number of valuable and interesting articles, and this volume in no wise falls behind in the excellence of its predecessors. It contains five papers on treatment and an equal number on surgery, six on medicine, three on obstetrics, one each on laryngology and otology. Contributors to this volume are such well-known men as Diculafoy and Bernard of Paris, Grocco of Italy, Squire and Trevelyan of England, and many of equal repute in the United States —Craig of Boston, Porter of St. Louis, Richardson of Washington, Lillienthal of New York, Müller of Philadelphia, etc. Their names are picked at random merely to indicate the interest taken in these clinics both at home and abroad. It would seem invidious to select the subjects of any of the articles for special remarks, but simply to indicate the breadth of these volumes a few titles will suffice: The Prevention and Treatment of Chronic Nephritis, the Treatment of Obesity, Syphilitic Aortitis, Myxœdematous Infantilism and Incomplete Myxœdema, Vesical Tumors, Placenta Prævia and its Treatment. Many of the articles are accompanied by illustrations which add oftentimes to their value, but there is a tendency with authors to overload their papers with photographs or drawings, either reproducing such as have appeared before many times, or introducing others practically identical. Good illustrations can be made so cheaply to-day, that badly colored ones are almost inexcusable, and detract from the pleasure both of articles and volume. Otherwise, the volume as a whole can be commended. R. N.

Studies in Gynecology. By JOHN A. SAMPSON, M. D. (*Albany, N. Y.: Fort Orange Press, 1907.*)

This illustrates a new method in teaching gynecology. It is essentially a well arranged student's note-book on gynecology, with excellent and numerous drawings by the author and a few stimulating questions relating to and accompanying each drawing. There is ample room for notes by the student himself. There is also an excellent index.

The simple and forceful illustrations, the illuminating questions and the logical arrangement all should make this an excellent aid in acquiring a knowledge of gynecology, and, when completed by the student, should be one of his most valuable reference books.

Mercer's Company Lectures on Recent Advances in the Physiology of Digestion. ERNEST H. STARLING, M. D., F. R. S. (*Chicago: W. T. Keener & Co., 1906.*)

This work contains so much interesting matter that it is difficult to write an epitome which shall be shorter than the book itself. Nevertheless, an attempt will be made to give some idea of its contents.

Food is required by the organism (Chaps. I and II) for furnishing heat and repairing tissue. For this the food must be completely disintegrated, a condition which is brought about by the action of enzymes. Enzyme action appears to be catylitic in nature. The author favors the view that catalysers have a twofold action (1) by bringing about a concentration of the molecules of the catalyte and (2) by furnishing an intermediary substance which assists in the chemical reaction. That such intermediary bodies are actually formed is made probable by a study of the reaction velocities.

Ferments are reversible in their action. Some scanty evidence indicates that in composition they are probably colloidal in character. The relation of toxin to antitoxin is similar to that of the enzyme and its zymolite (substrate).

In the secretion of saliva (Chap. III) there are no essential differences in the actions of the sympathetic and cranial autonomics Apparent differences are due to variations in vaso-motor actions on the gland. Secretion is a vital process. The cells throw out their secretory products and recoup from the increased blood supply. Some indication of the amount of energy required is found in the increased consumption of oxygen, which is four times as great as under normal conditions. The abstraction of water from the blood may be regarded as osmotic, the pressure being exerted by the split products of cell metabolism.

The lecture on digestion in the stomach (Chap. IV) is based chiefly on the work of Pawlow and his pupils. The experiments of Edkins prove that the second phase of gastric secretion is due to chemical stimuli passing to the gland cells by way of the blood stream and Pawlow was mistaken in attributing this to a local reflex. Thus to variations in the quality and quantity of this chemical stimulus may be attributed the apparent adaptation of the secretion to the requirements of the meal, a view more acceptable than that of the Pawlow school.

In the lecture on pancreatic secretion (Chap. V) after a discussion of the origin and action of secretion the conclusion is reached that it is doubtful whether in the activity of this gland the nervous system plays any part whatever.

Unlike the salivary glands (Chap. VI) the pancreas does but little work in overcoming osmotic pressure and can do but little work against mechanical interference with the outflow from the duct. Here also there is during activity an increased consumption of oxygen. There is histologically no fundamental distinction between the tubule cells and the islands of Langerhans, the latter being merely areas where cell division is taking place. There is nothing to indicate the part of the organ concerned in carbohydrate metabolism.

Enterokinase (Chap. VII) is a true "ferment of ferments" not merely a complement in Ehrlich's meaning of the word. There is no evidence that the character of the pancreatic secretion is adapted to the particular sort of food eaten.

The secretion of the bile (Chap. VIII) parallels that of the pancreatic juice and is produced by the same agency, namely, the action of secretin.

The secretion of the intestinal glands (Chap. IX) may be accelerated by mechanical means or by chemical hormones. One hormone is the secretin which also causes the secretion of bile and of pancreatic juice; the second hormone is the intestinal juice itself which causes increased production of succus, but has no action on the pancreas. The ferments of the intestinal juice are then discussed.

The picture presented by the movements of the alimentary tract (Chap. X) is essentially a combination of the results of Cannon's skiagraphic observations and those obtained at University College by other methods (enterographic, etc.) An essential feature of peristalsis is the inhibition which precedes contraction.

The style is clear, simple and forcible and compares favorably with Pawlow's classic on the same subject.

PERCY M. DAWSON.

Cleft Palate and Hare Lip. By W. ARBUTHNOT LANE, M. S., F. A. C. S. (*London: The Medical Publishing Company, Limited, 1906.*)

This monograph of 60 pages is a résume of various papers written by the author from time to time.

The greater part is devoted to a study of the factors that influence the growth of the naso-pharynx and the mouth, and of the bones that surround these cavities. He considers this most important, since the success which attends operations for cleft palate, so far as perfection of speech is concerned varies directly with the degree of development of the naso-pharynx, and with the freedom of the passage of air through it.

The author believes it very essential to separate the mouth from the nose as early in life as possible, and thinks operations for cleft palate should be done either the day after birth or very soon afterwards.

Lane's method, which is well described and illustrated, is quite different from the ordinary method of paring the edges of the cleft and bringing them together.

Textbook of Comparative General Pathology. By PROF. DR. TH. KITT. Translated by DR. WM. CADBURY and edited by DR. A. J. SMITH. (*Chicago: K. T. Keener & Co., 1906.*)

The general principles of pathology, to a consideration of which this book is devoted, have been worked out very largely by a study of the diseases and experimentally produced disturbances in animals and the similar conditions in man, usually of more vital interest to us, have frequently been cleared up in this way. It is not surprising, therefore, to find that Prof. Kitt's discussion of these general principles brings forward the names familiar to the student of human pathology, and, indeed, it is only the use of certain terms current among veterinarians and the constant references to cows and dogs that reminds one that the book is intended rather for veterinarians than for medical students.

The whole treatment of the subject, as might be expected from Prof. Kitt, is entirely rational and conservative and in accord with the best modern views. Dr. Smith's additions and notes give the essentials of the recent American contributions.

The book deals with the general relations of disease, predisposition and immunity, the causes, course and termination of disease; then with circulatory and metabolic disturbances, inflammation and repair, tumors and functional disturbances. All of these are treated broadly with illustrations and references to the diseases of domestic animals which are more specifically described in Prof. Kitt's Special Pathology. It is well translated, illustrated, and printed, and aside from its primary value to veterinarians, it may be highly recommended as a text-book of general pathology to other students of medicine.

Pathogenic Micro-Organisms, Including Bacteria and Protozoa. By WILLIAM HALLOCK PARK, M. D. (*New York and Philadelphia: Lea Brothers & Co., 1905.*)

The second edition of Dr. Park's Manual of Bacteriology has been very extensively enlarged and improved, and, in its present form, can be most cordially recommended, not only to students of bacteriology, but to advanced workers and practicing physicians. In preparing it, Dr. Park has taken advantage of his exceptional experience in public health work gained through several years' association with the Board of Health in New York City, and on this account the chapters on diphtheria and tuberculosis are extremely valuable, especially from the diagnostic standpoint. In addition to the vast amount of practical information contained in the book, Dr. Park has taken up in a very pleasing way the consideration of toxins and antitoxins and their mutual relationship. The sections devoted to this phase of the subject are not rendered obscure by the presentation of complicated formulas and diagrams, and are, we think, far more readily understood by the average student than the prevailing expositions in other textbooks. This clearness may be possibly due to the author's facility in expressing himself in excellent English or may result from his knowledge of the subject gained from research work and not purely from the literature. Too much space is not given Ehrlich's well-known theories, while careful attention is devoted to the observations of Nuttall, Wassermann, Metschnikow, Meyer & Ransom, Wright, and Neufeld.

Part III is given up to a consideration of protozoa by Dr. Anna W. Williams and Mr. L. B. Goldborn. While one may doubt the wisdom of including in a manual of bacteriology such a broad subject as protozoa, no one could possibly criticise the way in which the material is presented. Furthermore, a textbook dealing so largely with the subject of vaccination and serumtherapy would not be complete without a consideration of rabies and small-pox, and the authors have clearly justified themselves in their plan of treating bacteria and protozoa in the same volume. The section dealing with rabies is especially well written and bears the impress of coming first-hand from an authority on the subject.

One or two special points in regard to minor details in the book may be mentioned. No satisfactory description of *Bacillus ærogenes capsulatus* is given, the few paragraphs on page 380 being quite inadequate, when one considers the wide distribution of the bacillus and its great pathogenic importance. The *Bacillus icteroides* still finds a place in the list of pathogenic micro-organisms, although its relation to yellow fever can no longer be held even remotely possible.

In the section devoted to the bacteriological examination of water, in considering the isolation of the typhoid bacillus from this source, Dr. Park has not placed sufficient importance, we think, upon the few cases in which the organism has been obtained and identified by all the tests known to bacteriologists. Unless one admits the possibility of the typhoid bacillus surviving a considerable time in water, the etiology of enteric fever remains very obscure, and the rôle of infected water in spreading the disease correspondingly problematical. We now have a considerable number of cases on record in which *Bacillus typhosus* has been obtained from water and identified by its cultural reactions, its agglutination, and by the Pfeiffer phenomenon. Such observations, we take it, are of very great importance, and failure to include them renders the epidemiology of typhoid fever difficult to understand.

Lastly in the treatment of rabies by cauterization, Dr. Williams calls attention to the very great value of this measure in preventing the development of the disease and in ameliorating the severity of the attack, especially if the cauterization be carried out within a short time after the infliction of the wound. Furthermore, its value, even after the lapse of 24 hours, has not been disproved by experimental evidence. Since this practice has largely fallen into disuse or even disrepute, it is a matter of importance that its beneficial results should be properly estimated.

W. W. F.

Progressive Medicine: A Quarterly Digest of Advances, Discoveries and Improvements in the Medical and Surgical Sciences. Edited by HOBART AMORY HOWE, M. D., etc.; and M. R. U. LANDIS, M. D., etc. (*Philadelphia and New York: Lea Brothers & Co., Vol. IV, December, 1906.*)

This volume contains five reports on (1) disease of the digestice tract and allied organs, the liver, pancreas, and peritoneum; (2) genito-urinary diseases; (3) diseases of the kidneys; (4) anæsthetics, fractures, dislocations, amputations, surgery of the extremities and orthopedics; (5) practical therapeutic referendum,—all well treated by men recognized in the profession for their special knowledge in the subjects they discuss. For doctors

who have no good medical library of current journals to refer to, or who are too occupied in practice to read the literature of the branch of medicine or surgery in which they are most interested, this quarterly digest must prove itself of real value. Here in a volume of medium size, well printed, and with a good index, a busy practitioner can in a short time easily see the advances and changes which are constantly taking place in the knowledge and treatment of diseases, and so can keep abreast of the latest work done along all the lines of medicine and surgery. For the laboratory student, also, the book is useful, as he, too, can readily find in the volume reference to the more important articles, on which the reports are based. R. N.

A Treatise on the Motor Apparatus of the Eyes. By GEORGE T. STEVENS, M. D., PH. D. (*Philadelphia: F. A. Davis Company, 1906.*)

A perusal of this work unavoidably suggests the question: Are ophthalmologists the world over, so far as the muscular anomalies of the eyes are concerned, groping blindly in the dark, prescribing prismatic and other lenses for faults which are wholly unreal, and performing tenotomies for conditions which exist only in their imagination, or is the author a hobby rider of "monumental" proportions?

If, in most instances, the several varieties of heterophoria and all forms of non-paralytic squint are really, as the author tells us (pp. 261, 417, 418) caused by "declinations" (of which, it seems, there are two types, "normal" or "anomalous" (sic) declination and pathological declinations, p. 236) acting in conjunction with a departure from a condition which he denominates "euthyphoria" (of which, again, there are four kinds, anophoria, kataphoria, anotropia and katotropia) then, indeed, are ophthalmologists in general profoundly ignorant of the whole subject of what has been termed ophthalmic myology. But, on the other hand, if all this ex cathedra teaching of Dr. Steven's is but the outcome of, let us say, a psychic heterophoria on his part—and we cannot deny a strong bias in favor of this view—then the outlook is not so dark, and the ophthalmological world may breathe freely again and not wholly lose heart.

In considering how much weight should be given to these novel, not to say revolutionary views, it seems pertinent to inquire: Has the author established such a reputation as a pioneer in ophthalmological teaching as to lend import to whatever doctrines he may advance? Are his views in other directions, ophthalmological, sound, and his arguments in support of them logical and convincing?

The extravagance of the claims put forth in his "Functional Nervous Diseases" (1887) as to his success in curing epilepsy by operative and other treatment of the eyes, is a sufficient answer to the first inquiry.

The answer, in a negative sense, to the second inquiry is not far to seek. If there is one well-established fact in physiological optics, it is the close relationship which exists between "accommodation" and "convergence," between the conjoint action of the internal recti muscles in converging the optic axes and the action of the ciliary muscles in focusing the eyes for the sharp seeing of near objects. This intimate relationship, because it does not harmonize with his peculiar views regarding the etiology of squint, Dr. Stevens denies, and, fortunately for our purpose, he sets forth, on page 398, the grounds upon which he bases this denial. Let anyone familiar with the subject read this page, and he can reach but one conclusion as to the author's capacity for logical reasoning. In the extremely improbable case that he should ask for further evidence before coming to such a definite conclusion, let him read, on the two succeeding pages and on page 256, what is said as to the action of convex glasses in controlling convergent squint—that it is through their accidental prismatic effect, and not at all through lessening accommodative tension, that they accomplish this result.

We have spoken of the author's shortcoming as a pioneer investigator and as a logical reasoner. The amazing data, opposed as they are to the experience of all other observers, given in the "Table of elements in strabismus" (pp. 409 *et seq.*) would seem to indicate that he has one other noteworthy shortcoming—a lack of capacity for accurately observing and recording scientific facts.

In this table, which purports to give the state of refraction of the eyes in two hundred consecutive cases of non-paralytic squint, met with in private practice, it is set down that 74 (32%) of these 200 strabismic individuals were emmetropic (!). That is to say, the percentage of emmetropia was approximately twice as great as it is in normal-seeing, non-asthenopic individuals taken at random in any civilized community. Again, we find it recorded that of the 84 cases of divergent squint 23 only were associated with myopia, while 38 were associated with hypermetropia and 23 with emmetropia. And, again, that of the 67 cases of convergent squint hypermetropia was present in only 20, while emmetropia was present 29 times and myopia 18 times. These figures, well, if "astounding" is a stronger word than "amazing," we certainly should have used it in characterizing them.

In endeavoring to magnify the importance of his own contributions to the subject of heterophoria, the author tries to make it appear that previous to his publications on the subject little or no account was taken of the state of the muscle-balance except at the reading distance,[1] and that the tests employed had reference only to insufficiency of the recti interni. In this connection, he refers to the section on "Muscular Asthenopia" in Soelberg Wells "Diseases of the Eye," and remarks: "His tests for the affection were made at the near point." (p. 18). Had he read the whole of the section to which he refers, he would not have fallen into this error; for, after describing the vertical diplopia test as made at the reading distance, Wells goes on to say: "We must next test the degree of disturbance in the lateral equilibrium a little further off, and finally at a distance, a lighted candle forming the best object."[2] He would have found, moreover, on the preceding page this statement: "But if either the *internal* (italics our own) or external rectus considerably exceeds the normal standard of strength, the double images will not only show a difference in height, but also a lateral difference."

We were disposed to take exception to what is said (p. 333) as to the slight value of prisms in the treatment of heterophoria; but we hesitate to do so after noting that the author's statement upon this subject "is made from an experience doubtless greater than has been presented to any other observer, and is made without reservation." The air of complacence manifested in this assertion, it may be remarked, obtrudes itself upon the reader, from preface to index, with what, in the expressive language of Falstaff, might be termed "damnable iteration."

The statement (p. 450) that in the author's opinion word blindness "should be classed among the affections of the eye muscles" needs no comment.

Among the minor faults noticed in glancing over the pages of this book—besides such evidences of careless proof-reading as "Stratfield" for "Streatfeild" (pp. 407 and 496), and "Annals c'Oculistique" (first page of preface) for "Annales d'Oculistique," the "c'Oculistique" being corrected in the Errata, but not the misspelling of Annales—may be mentioned the reference (p. 329) to chloral and sulphonal as coal-tar preparations, and the statement (p. 454) that "in paralysis of an external rectus the

[1] Thirteen years before the appearance of Stevens' "Functional Nervous Diseases" the reviewer published in the American Journal of the Medical Sciences, Jan., 1874 (Vol. LXVII, p. 65), a paper, in which mention is made of tests of the muscle-balance for distant as well as for near vision; and even then it would have been absurd to speak of these tests (the well-known vertical diplopia tests of von Graefe) as novel.

[2] Diseases of the Eye, Henry C. Lea's Son & Co., 1883, p. 721.

head turns toward the side of the unaffected muscle," exactly the reverse of this being what actually happens.

Ophthalmology, unquestionably, is indebted to Dr. Stevens for introducing a very convenient terminology for the latent muscular anomalies of the eyes[2] and, less conspicuously, for directing attention to the significance of these anomalies, and were he content with this measure of credit the critic would be niggardly who denied it him. But, when he goes further and claims (pp. 19 and 20) that the conditions to which he gave these new names were previously unrecognized, he need not expect even a generous critic to concede the rightfulness of his claim, nor be surprised if the critic who is simply just should insist that in general what is new in his teachings, apart from his terminology, is but half true, and that what is true is far from new. S. T.

Chemistry: General, Medical, and Pharmaceutical, Including the Chemistry of the U. S. Pharmacopœia. A Manual on the Science of Chemistry and its Applications in Medicine and Pharmacy. By JOHN ATTFIELD, F. R. S., M. A., PH. D., F. I. C., F. C. S., Lecturer on Chemistry in the University of Edinburgh, etc. Nineteenth Edition. pp. 756. (*Philadelphia and New York: Lea Brothers & Co., 1906.*)

The first edition of this work appeared in 1867. Since that time there have appeared nineteen editions. This alone is sufficient testimony that the book has been a very useful one. The question which presents itself here is whether the work is a suitable textbook for the medical student of to-day. The whole subject of chemistry has made enormous strides since the earlier editions of this book appeared and demands correspondingly greater consideration in medical training.

The book includes a consideration of the following topics: Principles of Chemical Philosophy, Inorganic Chemistry, Organic Chemistry, Physiological Chemistry, Chemical Toxicology, Clinical and Microscopical Examination of Morbid Urine. In addition to this the concluding sections form a laboratory guide of Quantitative Analysis.

It is hardly necessary to state that the book is entirely inadequate for the medical student of to-day, as the mere enumeration of the subjects considered in this small volume is sufficient to establish the fact.

All of these branches require works by specialists in these subjects as medical education has advanced far beyond the point where this sort of book embracing the entire range of chemistry is desirable. The subject-matter is often so condensed as to be utterly beyond the grasp of any student depending entirely upon this book. It is far better suited for students of pharmacy than medicine. A. S. L.

A Textbook of Human Physiology. By DR. ROBERT TIGERSTEDT. Translated from third German Edition and Edited by JOHN R. MURLIN, A. M., PH. D., with an introduction by PROF. GRAHAM LUSK, PH. D., F. R. S. (*New York and London: Appleton & Co., 1906.*)

This work is attractively printed and bound in one volume, comprising 751 pages. It is the translation of the third edition of the well-known two-volume "Lehrbuch der Physiologie des Menschen" of Prof. Tigerstedt, which has enjoyed unusual popularity in Germany as a textbook for students of physiology since the publication of the first edition in 1897. The third German edition appeared in 1905. The translation is abridged, and, as stated by the translator in the preface, especially certain mathematical considerations concerning circulation and vision have been omitted, the idea being to bring the work within the reach of the second year medical student of this country.

Rather unusual in a book of this scope are the first two chapters, the former concerned with graphic methods, the latter with the general physiology of the cell. The former should be very useful to a student's first introduction to physiology, giving a fundamental conception as to by what means results are obtained and assisting him in the interpretation of physiological tracings. The second chapter has its usefulness for those students entering upon a study of medicine without previous biological training. It is with much regret that we realize that this chapter indeed has its place.

All those who are familiar with the writings of Prof. Tigerstedt are impressed above all with the conciseness and ease with which an effort is made to make each subject a unit, and, in so far as possible, complete. In an effort to abridge in certain parts of the translation, this important characteristic has been lost. The chapter upon vision suffers most in this respect. A fundamental understanding of the physical principals involved is necessary for the subject of vision, and if a student is unable to understand this, he will be unable to gain a proper conception of the subject itself. It is, however, not alone the physical and mathematical portion in vision that suffers at the hands of the translator. The result is an impression of discontinuity; rather a series of notes upon the subject than a connected account. This criticism applies to a somewhat less extent to the chapters upon circulation.

There are certain notable exceptions to this; especially the chapters upon the central nervous system, metabolism and nutrition. These are excellent for the purpose they are supposed to fulfill.

A few important references are given at the end of each chapter. In the reviewer's opinion, this is not so useful as references to certain articles of fundamental importance in the text.

Aside from these criticisms, the translator has performed his task well. The English is excellent, the proof corrections carefully done, and there is no trace of the original German.

J. A. E. EYSTER.

Mediterranean Fever in India: Isolation of the Micrococcus Melitensis. By CAPTAIN GEORGE LAMB, M. D., I. M. S., and ASSISTANT SURGEON M. KESAVA PAI, M. B., C. M., Madras. New Series. No. 22. Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India. (*Calcutta: Office of the Superintendent of Government Printing, India, 1906.*)

The writers report in detail 17 cases of Mediterranean fever which were studied carefully in regard to their specific agglutinating reaction with M. melitensis as described by Wright.

In many cases a definite diagnosis was obtained only by means of this reaction which is believed by them to be specific.

The results of other workers are reviewed in some detail. Numerous control experiments were made on natives of India, many of whom were undergoing inoculation against rabies, and no agglutination was obtained except in one case. This case one year previously had had a very suspicious fever of remittent type.

Of the entire 17 cases, 11 showed M. melitensis in cultures obtained by splenic puncture. The cultural characteristics of M. melitensis are described at some length.

The organisms obtained from the first two cases were used to inoculate monkeys who took the disease and ran a fairly typical course. The organism was isolated from their blood at various times and from the spleen and liver of one after death.

The smaller group of six cases gave a good agglutination with M. melitensis which was considered sufficient in the light of the preceding cases. The grade of dilution which was followed by a definite agglutination varies quite widely, from 1 to 40 in some to 1-1200 in other cases.

The organism was isolated from the spleen in all stages of the disease—usually in the acute febrile period. One case showed a

[2] The new names which he proposed for the manifest muscular anomalies—the several varieties of squint—have not been, and are not likely to be generally adopted.

mild relapse after a period of six months' freedom from symptoms. One attack seems from clinical evidence to confer an immunity for a long space of time.

In a foot-note mention is made of 19 additional cases from one of which the M. melitensis was isolated by splenic puncture. Many of the cases occurred in groups, forming definite epidemics but no conclusion is reached concerning the method of spread of the infectious organism. They conclude that Mediterranean fever is both common and widespread in India. Temperature charts of the individual case are appended. G. H. W.

The Anatomy and Histology of Ticks. By CAPTAIN S. R. CHRISTOPHERS, M. B., I. M. S. New Series. No. 23. Scientific Memoirs by Officers of the Medical and Sanitary Departments of the Government of India. (*Calcutta: Office of the Superintendent of Government Printing, India, 1906.*)

The writer calls attention to the importance of ticks as carriers of disease in some of the cattle fevers, relapsing fever in man and other unclassified "tick fevers" or spirilloses. He considers a careful anatomical description of two species to be all that is required for a clear understanding of all the known species which closely resemble one of the two examples: 1. Rhipisepholus annulatus; 2. Hyalomina ægyptium.

Pyroplasmosis in cattle, dogs, sheep, horses are transmitted by ticks and the same cycle holds for all. The female bites an infected animal and only adults of the second generation are infectious; the female dies immediately after laying her eggs, numbering from 100 to 10,000, according to the species.

The habits of the various ticks are described with care and vary greatly in different species. Their external anatomy has been carefully described by many writers, and this chapter is quite short, but he gives a careful description of the technique which he found useful in its study.

Internal Structure of Ticks.—This makes up the main bulk of the article, and the writer goes into considerable detail, which is justified by the fact that he could find no comprehensive work on this subject. His gross descriptions are much more complete and satisfactory than the microscopic ones. The process of digestion of the blood in the tick's alimentary canal is described microscopically and shown to be as a rule incomplete. Ticks examined months after a meal showed the presence of a black granular detritus in the diverticula of the alimentary tract and such residue is never passed into the rectum. The rectum is connected with the malpighian tubules and serves solely as their excretory receptacle.

The embryology of ticks occupies only a short chapter and one fact is emphasized, namely, that the yolk of the ovum becomes the system of alimentary sacs in the adult. It is shown that the alimentary sacs of the nymph of Ornithodorus contain the remains of the yolk of the ovum.

The plates are numerous and clearly drawn, but the lettering of many is faulty. G. H. W.

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